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The European Alliance Against America.

Nothing seems more natural than that European builders of tools and other machinery should point to the two facts that America has been and is a high-tariff country, and that the machinery interests are highly developed and prosperous and say that the one is cause and the other effect. Very many Americans will be found to sustain that view. But the foreigners go further and say, "Let us also adopt the high-tariff principle. Our machinery manufacturing business is quite infantile as compared with that of the United States. We need protection from their competition and unless we get it we shall be 'flooded' with the improved American machinery 'dumped' upon our shores and shall all be ruined. Let us follow the example of the Americans; shut out foreign machinery and grow rich and prosperous. Selah!" It is this sentiment that inspires the talk we hear of forming a general European alliance against America, and no doubt there are many well-meaning but misguided people over there who think that program would work as well in Europe as it has worked here. In this we think they are entirely mistaken and mainly because the conditions are so entirely difierent.

When the founders of the American Government formed its constitution they perceived clearly enough that the Union could not be held together if the different States were to be allowed to impose tariff duties upon goods coming from other States. They therefore inserted a clause in the Constitution prohibiting any State of the American Union from levying such duties. If it had not been for this constitutional prohibition we should undoubtedly have had duties imposed by most of the States upon goods coming from any other. Each State would have endeavored to "develop its own industries" and in fact would have found practically all the reasons for tariffs, retaliations, etc., that are now found with respect to our foreign trade. An American machinery builder would then have been practically restricted to the materials and supplies produced in his own State instead of having, as now, the privilege of buying them from any citizen of any State depending only upon which one can make the best terms. That is practically the situation to-day upon the Continent of Europe, each country has its tariffs—not so high to be sure as ours, but high enough to considerably impede trade passing over the various boundary lines. Instead of having as we have had here, and still have, absolutely unrestricted trade over practically an entire continent embracing a very great variety of climate and productive adaptability, each state or country over there imposes its own tariffs. While we have been levying duties against foreign goods American citizens could nevertheless buy practically every needed or even desirable article of food from that section of the country in which it could be produced cheapest.

Instead of New York State being allowed to levy a duty for the protection of the wheat fields of the Genesee valley wheat is freely grown and as freely shipped to any part of the country from the great wheat fields of the Northwest, and the same principle applies to all farm produce and to the products of the iron and other mines as well. Now it is to be remembered that no country in Europe is similarly situated. Germany, in response to the demands of the land owners there, has lately taken action that has greatly restricted the importation of American meats and we are informed that this is felt very severely by the poorer people of Germany, who are mainly depended upon to do the hard physical labor there. Whereas many of them could formerly afford meat upon their tables perhaps once a day, now the same people can scarcely get meat at all—in fact, do not do so except upon rare occasions. Our informant, a resident of Germany, says this will undoubtedly result either in reduced vitality and efficiency of these laborers or they will eventually get increased wages to enable them to pay the increased cost of the sustenance necessary to maintain them in fit condition, either of which will of course increase the costs of manufactured products. The fact is that no country of Europe comes anywhere near being naturally so independent of other countries as is our own, and therefore it seems quite certain that those who think that a plan that has worked well here will necessarily work equally well in Europe are doomed to disappointment. They may try such plans, but the manufacturer of the Continent can probably do it only by collusion with the agrarians—*i. e.*, land owners, who, in return for supporting the movement for increased duties on manufactured goods will secure corresponding increased duties on farm products. The final outcome of this will be starvation for thousands of the poorer work people, as was the case in England before the repeal of the corn laws and the whole system will break down, though it may last long enough to seriously injure American foreign trade.

The feature of this country about which Europeans have the least comprehension is its vast area and the consequent great diversity of its soil, climate and resources. Single States compare in area with European countries, while our climate ranges from semi-tropical to semi-polar. With the exception of Russia no other country of the world can compare with ours in this respect. Economically speaking we are literally a world within ourselves. There are but few necessities that we do not produce, and this has provided a field for the experiment of protection such as exists nowhere else. We are fully persuaded that what European legislators most need just now is a knowledge of these facts, which ought to show them that the history of protection here forms no argument for its adoption elsewhere.

The Group System of Drawings.

Our draftsmen readers will read with more than usual interest the article in another column in which is described the group system of arranging drawings as developed at the works of the General Electric Company.

The most perplexing problems of draw-

ing office administration are those which pertain to the use of drawings of parts designed for one machine in the construction of another and to the making of changes as they become necessary from time to time. These things do more to upset classification and indexing and to destroy records or make them obscure than all else combined. A third problem, which, while not so serious as these, still occupies a place in the front rank, is the reconciling of the conflicting requirements of drawings intended for machines, some of which are to be built and the others manufactured.

These problems grow with the growth of a business in either age or magnitude and these vary greatly with the character of the business. There is probably no place in the world in which the character and quantity of the work done combine to make these problems more serious or their solution more important than at the works of the General Electric Company.

With three hundred draftsmen at work nothing but the most thorough system can prevent endless confusion in the drawings, the work and especially in the indexes and other records. The system described is, to the best of our knowledge, new and the bare fact that the necessities of the situation in such a place have led to its development is sufficient to command attention.

Mr. Knox is the engineer in charge of the drafting department of the works. His article shows—what too many on this general subject do not—a thorough comprehension of the fact that conditions differ in different works and that drawing office methods must be adapted to the conditions to be met.

Railway Statistics.

From summaries which will appear in the Thirteenth Statistical Report of the Interstate Commerce Commission, the figures in the following advance statement are obtained:

On June 30, 1900, the total single-track railway mileage in the United States was 193,345.78 miles, an increase during the year of 4,051.12 miles being shown. This is a greater increase than that for any other year since 1893. The aggregate length of railway mileage, including tracks of all kinds, was 259,788.07 miles. There were 37,663 locomotives in the service of the railways on June 30, 1900, or 960 more than the year previous. The total number of cars of all classes in the service of the railways on the same date was 1,450,838, an increase of 74,922 being shown in this item. Of the total number, 34,713 are assigned to the passenger service, 1,365,531 to the freight service, and 50,594 to the direct service of the railways. Cars owned by private companies and firms and used by railways are not included. There was a decrease in the number of passenger cars per 1,000,000 passengers carried and a decrease in the number of freight cars per 1,000,000 tons of freight carried. The number of persons employed by the railways of the United States, as reported for June 30, 1900, was 1,017,653 or an average of 529 employees per 100 miles of line. As compared with the number employed on June 30, 1899, there was an increase of 88,729, or 34 per 100 miles of line. During the year ending June 30, 1900, $577,264,841 were paid in wages and salaries, an amount $131,756,580 in excess of that paid during the fiscal year 1895. The compensation of the employees of railways for the fiscal year 1900 represnts 60 per cent. of the operating expenses of the roads and 39 per cent. of their gross earnings.

The amount of railway capital outstanding June 30, 1900, was $11,491,034,960, or a capitalization of $61,490 per mile of line. The number of passengers carried during the year ending June 30, 1900, was 576,865,230, an increase for the year of 53,688,722. For the year ending June 30, 1900, the gross earnings from the operation of the railways in the United States, covering an operated mileage of 192,556.03 miles, were $1,487,044,814, being $173,434,696 more than for the preceding fiscal year. The operating expenses were $961,428,511, the increase in this item being $104,459,512. Disregarding taxes paid to the United States Government under the recent internal-revenue act and small amounts not apportioned by States, there accrued against the railways of the United States during the fiscal year in question taxes to the amount of $47,415,433, or an average tax of $254.78 per mile of line. The total number of casualties to persons on account of railway accidents during the year ending June 30, 1900, was 58,185. The aggregate number of persons killed in consequence of railway accidents during the year was 7,865, and the number injured was 50,320.

Personal.

A. S. E. Ackermann, honorable secretary of the Civil and Mechanical Engineers' Society of London, is visiting this country.

Mr. C. O. Boalth, who is quite well known in the machinery business of Germany, has become connected with the Berlin house of de Fries & Cie.

H. B. Schenck, formerly manager of the New York branch of the Tanite Company, manufacturers of emery, emery wheels, machinery, etc., is now agent for the company and has opened an office at 39 Cortlandt street, New York.

J. C. Phillips, of Greensburg, Pa., has resigned his position with the Best Manufacturing Company, of Pittsburgh, Pa., to accept the superintendency of the Hempfield Foundry, Limited, of Greensburg, Pa.

Some time ago we mentioned the fact that neither Mr. Becker nor Mr. Brainard now have any interest in the Becker-Brainard concern. To avoid misunderstanding we should say that Mr. Becker is still with the company, he having made a contract with them before disposing of his interests, which contract has not yet expired.

W. Gratz, E. E., who has been connected with the International Correspondence Schools, Scranton, Pa., has resigned to accept a position with Mr. Elmer G. Willyoung, New York, maker of electrical measuring instruments. Mr. I. McC. Bean, formerly of the Dickson Manufacturing Company, has succeeded Mr. Gratz as editor of "Science and Industry."

Obituary.

Walworth O. Barbour, of Barbour, Stockwell & Co., iron founders and machinists, Cambridge, Mass., died in Boston, July 2. He was born at Saratoga, N. Y., about fifty years ago, and had been in business more than twenty years.

Arthur Orr, for many years the builder of the coining presses for the different mints of the United States, died at Moorestown, N. J., July 18, eighty-four years old. He built coining presses for several foreign countries, this being his one specialty.

William Wallace Tucker, for a long time foreman of the screw machine department of the Pratt & Whitney Company, and for the last three years in business for himself in the Tucker Supply Company, died at Hartford, Conn., July 7, sixty-three years old. He was well known as an inventor of mechanical specialties.

Mr. Jules A. Labram, who for some years was employed in this country with Prof. Sweet and at the Springfield Armory, but who for some years past has held important positions in Buda-Pesth and is now located in Paris with a machinery house, is looking about in this country, and expects to return to France in about a month.

Technical Publication.

We have received from the author, Mr. E. H. Putnam, of Moline, Ill., a pamphlet reprint of his article entitled "The Economic Status of Wages," which was published in the journal of the American Foundrymen's Association for June. The principal proposition of Mr. Putnam is, in substance, that a universal high wage rate is necessary in order to get the highest general rate of profit to the employer—that a high wage rate will make prosperity, while a low wage rate will cause business depression. Others have advanced this idea before; but we believe the arguments by which Mr. Putnam aims to sustain his position are new. Whether they are all quite valid or not, we will not pretend to say. We are inclined to think, however, that the matters treated do not go suffi-

ciently near the basis of things to account for the phenomena which Mr. Putnam attempts to establish the relations of. Those interested can, we presume, obtain a copy of the pamphlet by addressing the association as above.

Inquiry for Machinery.

(155) Wanted, name and address of manufacturer of a machine to straighten cold-rolled mild steel strips about 2 feet by 4 inches by 1-40 inch, by stretching them infinitesimally.

The tramp steamer "Guernsey" lately lost her propeller and tail shaft far out in the Pacific, and the engineer successfully accomplished the task of putting in at sea a spare shaft and propeller which they had on board. Their ballast cargo was shifted so that the stern bearing was brought out of the water. Two of the four blades of the propeller had to be cut off before they could handle it.

An electric motor car has recently run in England 94¾ miles on one charge. The total weight was 39 cwt. and the weight of the battery was 22 cwt. Four persons were carried at an average speed of 12 miles per hour.

The first commercial vessel driven by the Parsons turbine has recently had her trial trip on the Clyde. She made 20 knots for three hours. There was an almost total absense of vibration.

A first-class torpedo boat, built for the Dutch Government by Yarrow & Co., at Poplar, England, was recently launched with steam up, and she steamed away at once on a trial trip.

Commercial Review.

New York, Monday, July 22.

ENGINE MARKET AND OTHER NOTES.

The engine-building establishments whose operation has been hindered by strikes have to a great extent resumed their normal functions. The strike has proved an annoying obstacle to business through its effect on deliveries, but the month of July has been marked by a resumption of operations, the men at the various works re-entering in a body or trickling back one by one, as the case may be. Trade for the present is quiet to a trifling extent only and a favorable opinion exists as to its retrospect and outlook. Off-hand comparisons of the engine trade of the past half year with that of a year ago in individual cases generally indicate an equality or a preference for this year, the conclusion tending rather in favor of 1901. At one of the Corliss type engine offices a greater amount of business had been booked by the end of February this year than during all of last year.

The market in high-speed engines for New York city installation is just now a little quiet.

The preparation of specifications and receipt of proposals for the engine plant of the New York Rapid Transit Subway is a matter of interest to all engine builders, though it is fruit that hangs too high for most of them. Eight engines are called for of 7,500 indicated horse-power each at best efficiency and 11,000 at maximum power; also 48 horizontal water-tube boilers each with 6,500 square feet of heating surface. These engines are to resemble in design and size those with which the Manhattan Elevated is being equipped. The latter, it may be remembered, are built by the E. P. Allis Company.

We may add that the specifications for generators for the subway have also been given out. Eight 5,000-kilowatt three-phase alternators are called for. Proposals have been put in and it is not unlikely that the award will be made within the next sixty days. Specifications for the rolling stock equipment have not yet come along.

President W. R. Fleming, of the Harrisburg Foundry & Machine Company, has gone abroad to cultivate the business of the company in European markets. This concern has taken in some 50 per cent. more business this year than in the corresponding portion of last, as far as the New York office is concerned, at least, and July has proved a particularly active month. A contract has recently been booked for a 300 horse-power and a 200 horse-power tandem compound Harrisburg standard engine for direct connection to Crocker-Wheeler generators, to be installed in the plant of the Otis Elevator Company, at Yonkers, N. Y.

The Allis-Chalmers Company has just placed contracts for the steel and iron to be used in the construction of its second large machine shop at West Allis, Wis., and it is stated that the company will go right ahead with the erection of three of these shops, as well as the foundry. Each of the shops will be 575 feet in length and 120 feet wide, with two 125-foot galleries. The foundations for two of them are now well under way. The company has already contracted for an entire new set of machinery for the first shop. The main shop, which will be at right angles to the machine shops, five to seven in number, will be extended, from time to time, as the additional shops running out from it demand, until it will eventually be one-half mile in length. One of the new 575-foot shops will be larger than the entire old Corliss engine plant.

It is understood that the contracts which have been obtainable by the E. P. Allis Company this year have been in excess of those in the first half of last year, but the acceptance of new work has been limited by the capacity of the plant.

The A. D. Granger Company has recently sold six vertical engines in sizes of 25 horse-power and larger, to the New York Shipbuilding Company, Camden, N. J., for lighting vessels.

The Ames Iron Works, Oswego, N. Y., are working night and day.

A feature of trade reported by one prominent engineering firm is a great deal of car shop work, part of it being railroad shop work.

Among work of the character alluded to, the folowing examples might be given: The contract for the erection of the Pullman Palace Car Company's shops at Wilmington, Del., has been awarded to the Sollitt Company, of Chicago. The estimated cost of the work is something like $200,000. There is said to be no longer doubt that the pressed steel car plant of the Southern Car and Foundry Company, for which a site was secured at Ensley, Ala., several months ago, will be erected soon. The Osborn Engineering Company, of Cleveland, Ohio, has drawn the plans of the buildings and will superintend their construction. The plant will employ 1,200 men. The engineering department of the Pennsylvania Railroad Company is making plans for a roundhouse, machine shop and car building in Camden, N. J.

Midsummer dullness rules in the local machine-tool market.

The funereal quiet in Navy Department requirements for machine tools is broken by a call for a few for the Portsmouth (N. H.) Navy Yard for which bids are to be opened to-morrow, July 23.

There appears to be a great amount of careless bidding on government contracts—so much so that when any estimate is put in that departs very far from the normal it is casually remarked upon in the trade as having probably been a mistake. The authorities are more or less accommodating in such cases and sometimes allow the rectification of such errors, at least before the opening of bids. An instance of this in an important electrical contract occurred recently. A precedent on the other side has just been set, however, in the case of a Norfolk (Va.) contractor who bid on the construction of a stable for the Bureau of Yards and Docks, Navy Department. He declined to carry out his contract when awarded, on the ground of an error in making the bid, whereupon the Department awarded the contract to the next lowest bidder at $6,690 and informed him that he must pay the difference—$599.06—between that and his own. It might therefore be well to take a little more pains in estimating upon machinery and supplies for the Navy Department than sometimes has been the case.

The New Process Raw Hide Company, Syracuse, N. Y., has received an order from an Eastern machine company for ten pairs of gear wheels, the larger to be cut cast iron and the smaller New Process raw hide, making a noiseless combination. The cut cast iron gears run

from 20 to 80 inches and the raw hide pinions from 6¾ to 16 inches diameter. The amount of the order exceeds $2,000.

BRITISH AND FOREIGN NOTES.

The tool market in mid-England is reported to be flooded with second-hand machines from dismantled cycle factories. These machines are taken up by buyers and turned to other lines of manufacture in preference to the more expensive new tools of similar types. In Scotland trade in new tools is also slack and it is suggested that prospective buyers are waiting to see what they can pick up after the Glasgow Exposition.

For all the British market is not all that might be desired, the screw machines of the Acme Machine Screw Company are at present having a splendid run in England, and the English agents for these machines have just sent over a hurried notification that their stock is exhausted and that they want some more.

Besides the order for eight cranes placed by the British Westinghouse Electric & Manufacturing Company with Craven Brothers, of Manchester, as mentioned last week, the company has contracted for eleven cranes with Higginbottom & Mannock, of Manchester. Altogether, it is estimated, some $100,000 has been expended in England for the equipment of the new works.

A machinery house in New York has received a communication from an English firm handling American tools inquiring if it would not be acceptable were they to ship some American-built tools they have on hand back to this country. Evidently there is an exaggerated impression abroad of the effects of the machinists' strike.

The British Iron Trade Association proposes to investigate American competition. For a long time past the press has teemed with matter on this subject, which it is feared will have an effect on foreign buyers prejudicial to British manufacturers. The Board of the association take the ground that what has already been published on the subject shows that there are two sides to it and they believe that an investigation is called for under judicial, comprehensive and expert conditions.

The Mining Journal, Railway and Commercial Gazette, London, commenting upon the mining machinery renewals that will be required in South Africa says: "It is to be feared that unless the English makers are prepared to pursue a somewhat more energetic policy than they have carried out in the past they may find their trade filched from them by the deft fingers of American competition." The journal then makes a charge of lack of perfection and durability on the part of American plant, while admitting its initial cheapness and adaptability, and concludes as follows: "There is reason to believe that something like an American invasion of the Rand will shortly take place, and it certainly behooves the English manufacturers to be beforehand and secure the markets. They have the advantage in point of nationality, accessibility and priority of possession; the only things they want are a little more push, and rather wider range of modern and more elastic ideas."

Consul-General Stowe reports to the State Department from Cape Town: The plague now prevailing in this colony, together with the war (which compels vessels from United States ports to lie in the bay for days at a time before dockage facilities can be obtained), has caused orders for certain goods always obtained in the United States to be sent to England. Street-railway supplies, for instance, are ordered there at an excess of freight and cost.

Consul Warner writes the State Department from Leipzig that it is reported that the Reichstag will pass a law compelling American exporters to Germany to make out invoices covering the shipments, these invoices to be authenticated by the German consul in the United States in whose district the goods were produced. It is alleged that such a course will help the officials in perfecting the statistics of the imports from the United States, and will also throw another obstacle in the way of American exports to Germany.

CHICAGO MACHINERY MARKET.

Some of the electrical engineers say they cannot see any vacation in sight this summer, because of an unusual number of inquiries for equipment. The business is directly before them and if it is conscientiously attended to they have no idle moments for some time to come. Much of this trade is large work, and much of it special, consisting of new applications, so that the preliminary and detail labor is greater than it has been. Street railway work is active and the installation of power plants for factory operation is equally brisk. The Arnold Electrical Power Station Company is working on plans and specifications for a large heating, lighting and power plant for the Oregon Short Line shops at Pocatello, Idaho, the boiler capacity being about 2,000 horse-power. They are also preparing plans for a smaller electrical plant for the Chicago & Alton road at Springfield, Ill. One large Western machine shop has just contracted for a complete equipment of motors, each lathe and other machine tool to be operated by its individual motor, but publicity has not yet been made. Kohler Bros. have taken the contract to construct and equip a forty-two mile electric road between Battle Creek and Cold Water, Mich., and have commenced work.

Business is not uncommonly lost by electrical machinery makers because desired deliveries cannot be made. Of course the trade goes somewhere, and there seems to be quite enough to go around. Factories are commonly running overtime and prices show a little improvement over what they have been this past spring.

The Crocker-Wheeler Company office in Chicago has done as much business during the first three weeks of July as for the entire month of June. Much of this trade has been small work, and much, the sale of additional motors to plants previously installed. The stock yards have bought quite heavily. This company has sold an electrical equipment to Armour & Co. for installation in a fertilizing plant at Atlanta, Ga., including a 150-kilowatt generator and motors of about 250 horsepower. It has also sold motors for an air compressor in the new Marshall Field building at Chicago.

Among sales recently made by the Eddy Electric Manufacturing Company were three large motors for the National Malleable Castings Company, Indianapolis, Ind., two large motors for the Rochester Glass Company, Rochester, Pa., and a 100-kilowatt generator for the Ashland Gas and Electric Light Company, Ashland, Ohio.

The Northern Electrical Manufacturing Company has decided to enlarge its shops at Madison, Wis., to about double the present capacity, at a cost of about $100,000. The company has taken many orders during the past few weeks.

The Milburn Wagon Company, Toledo, Ohio, placed an order last week for forty-one motors, ranging from 7½ to 75 horsepower each. The entire plant is to be operated by electricity.

Quotations.

NEW YORK, Monday, July 22.

Pennsylvania Foundry Pig Irons, Jersey City delivery, good brands:

No. 1 X	$15 15 @ 15 50
No. 2 X	14 65 @ 15 15
No. 2 plain	14 15 @ 14 65
Gray forge	13 75 @ 14 25

Alabama Pig, New York delivery:

No. 1 foundry, or soft	15 00 @ 15 50
No. 2 foundry, or soft	14 25 @ 14 75
No. 3 foundry	13 75 @ 14 00
Foundry forge, or No. 4	13 25 @ 13 50

Bar Iron—Base sizes—Refined brands, mill prices on dock, 1.58c.; from store, 1.80 or 1.85 @ 1.90c.

Tool Steel—Base sizes—Good standard quality, 7c.; extra grades, 10c. and upward.

Machinery Steel—Base sizes—From store, 1.90 @ 2.00c.

Cold Rolled Steel Shafting—Base sizes—From store, 2½ @ 2¾c.

Copper in carload lots—Lake Superior ingot, 16¾ @ 16⅞c.; electrolytic, 16½ @ 16⅝c.; casting, 16¼ @ 16½.

Pig Tin—27½ @ 28c. for 5 and 10-ton lots, f. o. b.

Pig Lead—For wholesale lots, 4⅜c., with .02½ @ .05c. extra for carloads.

Spelter—3.95 @ 3.97½c., New York.

Antimony—Cookson's, 10¼ @ 10⅜c.; Hallett's, 8¾c.; U. S., 8½ @ 8¾c.

Lard Oil—Prime City, 69 @ 70c. in an ordinary jobbing way.

An Outline of the Drawing Office System of the General Electric Company.

BY S. L. G. KNOX.

From time to time papers have appeared advocating the one piece per sheet idea of making drawings, with a statement of the advantages that may be attained thereby. Many people, while admitting that the system has decided advantages, feel that it would not be suitable to their particular work and point out the troubles that would be brought about were they to adopt this system. In fact the general comment on most drafting room systems as described from time to time, is that the particular system under discussion would not be suitable for any line of work except the particular one on which it was developed.

There can be little doubt that the cheapest way to produce a set of drawings for any particular machine, leaving out of the question the bearing of that set of drawings or of parts thereof upon past and future work of a similar nature, is to make the drawings to as small a scale and on as few sheets as practicable, and to put on the drawing sheet and in connection with each particular piece the statement of material, number of pieces wanted and any special notes as to manufacture. The above plan permits of a minimum amount of red tape, and makes it unnecessary for draftsmen to be guided by any rules other than a knowledge of mechanical drafting. There will be no cross references, no duplication, in general 100 per cent. of the time devoted to drafting and 0 per cent. to system. The above method of making drawings assumes that but few pieces are to be made alike in the shop from any one piece on the drawing and that the cost of the drawing is therefore an important percentage of the cost of the shop work.

The time comes, however, in every manufacturing plant when it is found that new machines are to be built in which parts of machines previously designed may be used, and, without more red tape than in the system described above, there is nothing to do but to draw over again the parts which can be used on the new job. While this plan is undesirable on account of the expense of redrawing something already delineated on another sheet, that is the least of the objections to this method. The very fact that certain parts can be used on several different machines makes it probable that those are the parts which it will best pay to manufacture in quantities with special forming tools, jigs, dies, etc. If the pieces are shown on different drawings they are likely to be sent into the shop at different times with no special indication of their identity, and where considerable work is handled, several orders for the same thing may be going through the shop at approximately the same time, but never grouped into one batch. Work may be going through the shop for which special tools were gotten up at a previous time, but being shown as an independent piece on a new drawing, the establishment of its identify with the old piece frequently depends on the memory of the foreman (who may be a different man or a very busy one), and the special tools lie idle while the new order is made up. Again, it may be intended to use the same parts as those previously used and for which special tools have been developed, but some slight interference appearing during the progress of the job, the standardized part is altered, thereby throwing it out of the class of cheap manufacture, whereas had the only existent drawing been a standard one showing that it was a piece frequently used, much more effort would be made to avoid altering it. It may be replied to this that the designer, who alone can alter the drawing, will know the standard piece when he sees it, else he would not have put it there in the first place. Experience shows, however, that this particular point is the one on which the greatest improvement has been made by the refusal to redraw a piece, and in actual practice it was found that the designers showed a constant tendency to freely change standard pieces when shown on the drawing of the job, but that when the only way to find the drawing of the piece was to find it on a standard table very much more respect was shown for its immutability. Again, such pieces if not redrawn are always referred to by the same piece mark in the shop, and if much used get to be known by that mark and frequently identified without the drawing.

Where all the output of a shop is one general line, so that each man in that shop gets but a very limited variety of pieces, and where no one except the assembler handles more than one or two pieces of the job, the one piece per sheet idea may be a useful one. If 1 inch marked on a drawing meant 1 inch on the finished piece, one of the greatest objections to the one piece per sheet would be overcome, but as nothing which is marked 1 inch will be made *exactly* 1 inch in the shop, and as various pieces each bearing the same dimension on the drawing are intended to have different dimensions, dependent upon the way in which they go together, it is to the highest degree essential that the workman, even though engaged upon but one piece at any one time, be given an intelligent idea of the relation of this piece to its neighbors, else unnecessarily accurate work, meaning unnecessary expense, will be put on, or an undue amount of hand work in assembling will be required. This unless the whole range of work be very small, as noted above, or else the workman be supplied with jigs and forming tools for every operation. The argument that the men soon get to know what allowances to make is not a good one, for even where there is not too great a variety to permit this, men are coming and going, and a new man is seriously handicapped, or must lean too hard on the foreman.

There can be no doubt that it costs more to produce a set of drawings on the one piece per sheet plan than where a dozen or twenty pieces are shown on a sheet. There is almost certain to be a more or less constant element of time lost between stopping work on one drawing and beginning it on the next, whether the drawing be small or large. Any man who is not on piece work will take more or less of a rest when a natural stopping place occurs, and a natural stopping place is the completion of a sheet. He will go after a new piece of drawing paper or tracing cloth, and in general the time lost due to starting and stopping, trimming up the sheet, putting on border line, title, etc., will be greater on ten small drawings than on one large one. This merely applies to cost in the drawing room. The general argument made for the single piece per sheet idea is in behalf of the shop, but in the writer's experience the strongest objections to the single piece per sheet system come from the shop, unless the variety of the work is limited. The general objections, beside those given in the preceding paragraph, are the very large number of sheets which the foremen, clerks, inspectors and assemblers have to handle and keep track of, together with the fact that the number of pieces wanted and frequently the material of which made and other essential information are given on still another record, the specification of the job. The very multiplication of the drawings brings other multiplications and subdivisions in its train.

The writer will describe a system which is a compromise between the two outlined above, and which is found satisfactory from both the point of view of the drawing room and the shop in a concern employing over three hundred draftsmen and having a total force of over twelve thousand men. Related pieces are drawn on one sheet, and the full information as to the material of which made, pattern number, piece number, number of parts wanted, etc., is given on the drawing sheet, and while the number of sheets necessary to the manufacture of a given piece of apparatus is thus reduced to a number readily handled and kept track of, all necessity for duplicating the drawings of single pieces is avoided. This scheme is known as the "Group System" and has certainly been found satisfactory and time saving in the concern referred to, where probably as great a variety of apparatus is manufactured, and over as wide a range of development, from the most highly standardized pieces up to the newest invention still in an experimental state, as can probably be found in any manufacturing concern in the country. The essential features of this system will be evident from an inspection of the figures.

Fig. 1 shows the title of a drawing un-

der this system as made up to quite recently, and Fig. 2 shows a title involving the same principle, but somewhat concentrated. Fig. 1 probably represents the arrangement that will be most useful to the greatest number of people, though the title of Fig. 2 is satisfactory where the system is in use, on account of the larger scale on which manufacture is carried on. Under these conditions titles are found to be relatively unimportant, and the only sure way to specify anything is by an absolutely specific number combination. In the great majority of places, however, the name of the job is an indispensable handle by which to refer to the work on hand. In any place where "building" rather than "manufacturing" predominates, the title of the specific piece of apparatus for which the drawings are to be used is so

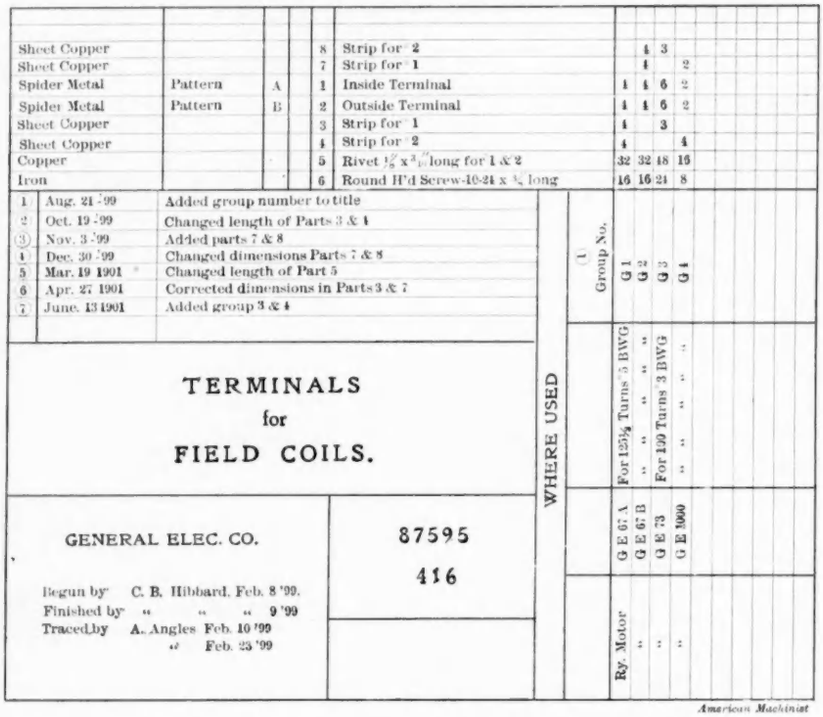
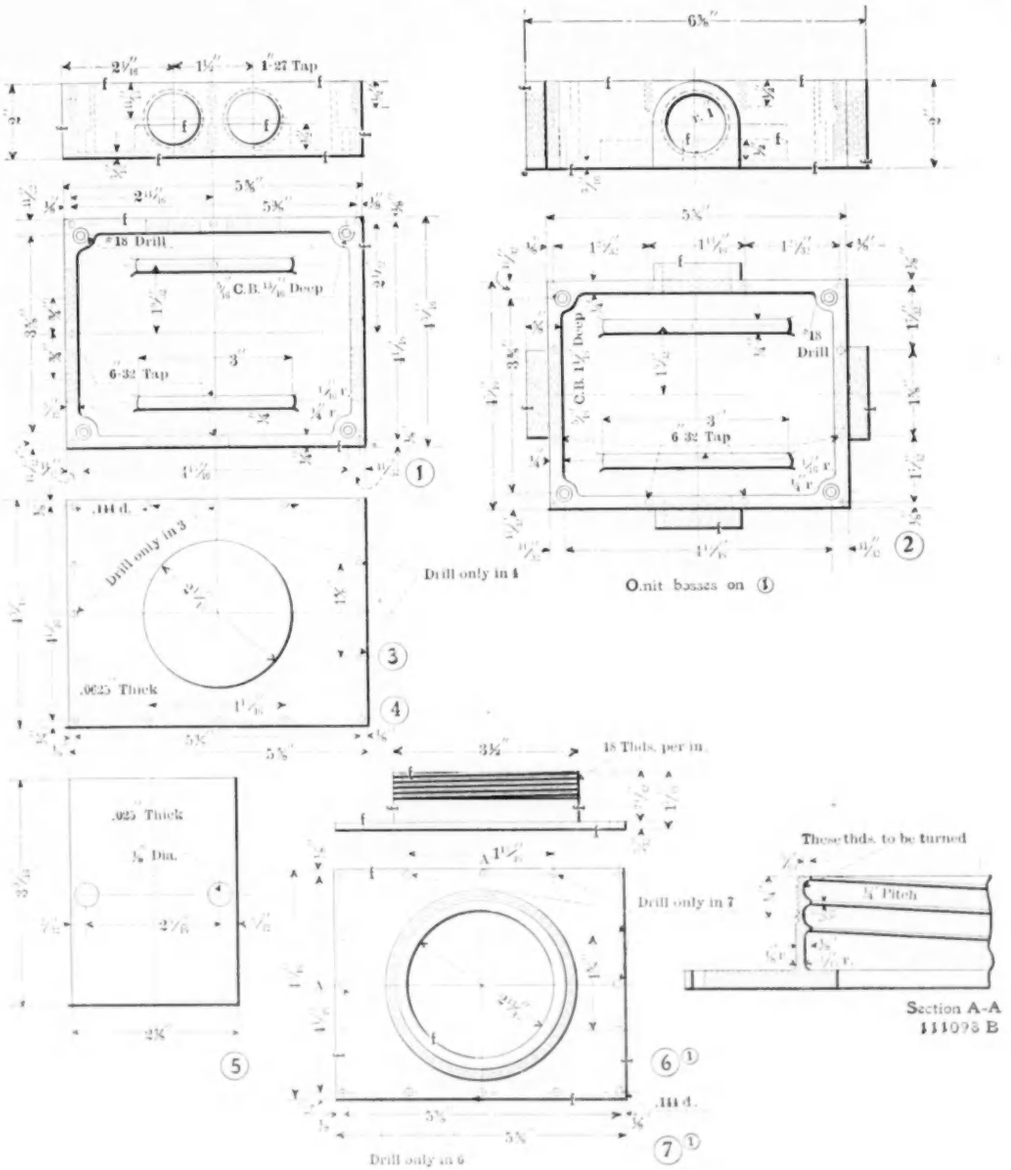

Sheet Copper 8 Strip for "2 4 3
Sheet Copper 7 Strip for "1 4 2
Spider Metal Pattern A 1 Inside Terminal 1 1 6 2
Spider Metal Pattern B 2 Outside Terminal 1 1 6 2
Sheet Copper 3 Strip for "1 1 3
Sheet Copper 4 Strip for "2 4 4
Copper 5 Rivet 1/2 x 3/16 long for 1 & 2 32 32 48 16
Iron 6 Round H'd Screw-10-24 x 3/8 long 16 16 24 8
1 Aug. 21 '99 Added group number to title
2 Oct. 19 '99 Changed length of Parts 3 & 4
3 Nov. 3 '99 Added parts 7 & 8
4 Dec. 30 '99 Changed dimensions Parts 7 & 8
5 Mar. 19 1901 Changed length of Part 5
6 Apr. 27 1901 Corrected dimensions in Parts 3 & 7
7 June. 13 1901 Added group 3 & 4
TERMINALS
for
FIELD COILS.
GENERAL ELEC. CO.
Begun by C. B. Hibbard, Feb. 8 '99.
Finished by " " " 9 '99
Traced by A. Angles Feb. 10 '99
" Feb. 25 '99
87595
416
WHERE USED
(1) Group No.
G 1
G 2
G 3
G 4
For 125 1/2 Turns 5 BWG
For 199 Turns 3 BWG
G E 67 A
G E 67 B
G E 73
G E 1060
Ry. Motor
American Machinist

FIG. 1. OLD FORM OF TITLE ON THE GROUP SYSTEM.

essential to the organization and way of looking at things, that a system that would not show how this could be incorporated would present no attractions whatever. Referring to Fig. 1, it will be seen that a complete specification is given of the pieces shown on the drawing, including the number of pieces of each needed in making up one piece of the apparatus of which it forms a part. Up to this point the sheet and its title are identical with the elementary drawing system first described, where one set of drawings applies to but one job. At the left and top the first column contains the material, the next the call for a pattern (if pattern is required), the next the pattern letter, and the next the sheet number of the piece. The actual pattern number is made up by combining the drawing number and pattern letter given in the title—for example, 87595A. These piece sheet numbers are also placed inside of circles and alongside of the pieces to which they belong, as fully shown in Fig. 2, which represents a complete sheet. The column to the right of the sheet number of the piece, Fig. 1, gives the name of the piece, and to the right of this are a series of columns for the different "groups" which form the distinctive feature of the method. The first of these columns shows the number of each piece (up to piece No. 6, as pieces 7 and 8 were added later) required for the first job for which the parts were used, namely the "Ry motor G E 67A," this combination of parts forming the group "G1." At a later date parts 7 and 8 were added—these parts being changes from 3 and 4, and a new combination was made up to form group "G2," this combination occupying the second of the group columns. Later on two other groups were made up, and room remains for several more.

Within this table and above the title proper is a list of changes and their dates with reference numbers at the left, these reference numbers being also added in small circles alongside the larger piece number circles, as shown in Fig. 2, in which the system is essentially the same though considerably abbreviated. In Fig. 2 the piece numbers, as entered in the table, are consecutive from bottom up, by which arrangement the numbers are still consecutive after additions have been made. In this system a drawing number does not convey any information to the shop as to what pieces should be made from that drawing, but a drawing number combined with a group number given on a drawing list or order does convey this information. For instance, Drawing No. 999 Gp. 1 means, make for each piece of apparatus on this order as many pieces of each part shown on drawing No. 999 as are called for in Gp. 1 of that drawing. If, as is almost invariably the case, more than one group has been written up on the sheet, it is altogether likely that there will be more entries of names of pieces in the title than there are entries of the numbers of pieces wanted in Gp. 1. The workman, however, ignores all parts shown on the drawing which are not entered up under the group to which he is referred. If there are twenty pieces on the sheet, there may be five or ten or twenty pieces in the particular group to which he is referred by the Drawing List of the job, but he pays no attention to any pieces on the sheet except those falling into that group.

When this system was first started, the particular pieces of apparatus in which any group was used were specified on the drawing. It was found, however, that the same group might be used on a number of different pieces of apparatus, in which case attempting to give the names of the apparatus for which used unduly increased the number of entries in the title, thereby taking up too large a proportion of the sheet, and it was soon decided to only state the first piece of apparatus for which any particular group was used. This, however, in turn was found to be rather unnecessary, as the Construction Specification, or Drawing List, which gives the drawing number and group number of all the sheets to be used in making any given piece of apparatus, carried the name of the apparatus, and it was therefore no more necessary for the drawing to repeat this name than for a pattern to carry on it the full title of the apparatus for which used. It is, however, unquestionably convenient in picking up a sheet to have some name from which to get a general idea of the line of apparatus for which the sheet is intended. The original title has therefore been modified, as shown in Fig. 2, which occupies much less space on the sheet, and only gives the name of the apparatus for which the parts shown on the sheet were first made, the specific pieces of apparatus for which the various groups were made being omitted. Changes of any character made on a sheet after its first issue are noted in the column at the right-hand side of the sheet, together with the date and a number connecting the changed note with the place on the drawing at which the change was made. The dates on which groups are added to the sheet are entered in connection with the group numbers, and it is therefore always possible to tell whether or not any given change was made before or after the addition of any specific group. As a record is kept showing the original condition of the drawing and all changes made thereon, it is always possible to tell



just how any piece of apparatus was built. About half of all the apparatus built by this company, for which drawings are required differing in some elements from any previously produced, is made by the addition of groups to drawings already in existence. Under the system first referred to, there would be required about twice as many new drawings of the same average size as are now produced, and under the second the making up of many fully detailed specifications, instead of simply writing down the number of pieces wanted, and issuing a new Drawing List which will have on it probably not more than one-tenth to one-twentieth as many entries as would be required on a complete specification. In fact, under this group system it is practicable and usual to frequently make several different pieces from the drawing of one piece, the altered together with the common dimensions being brought into the new group by new piece marks.

To recapitulate, the master record of this drawing system is a Drawing List, or Construction Specification, which bears the name of the apparatus which it describes and carries the drawing numbers and group numbers necessary for the building of that apparatus. One of these drawing lists is shown in Fig. 3. On receipt of this

1	1	Rainbow Packing				11	Disc, for 8 3½ dia. x .0625 Thick		
1	1	Rainbow Packing				10	Gasket for 6 & 7 3 7/8 d. x 1/8 x 2 7/16 hole		
12	8	Steel				9	6-32 R. H. Scr. 1/4 long for 1-2-3-4-6-7		
1	1	Comp. M.	Pattern	D	8	Cap for 6 & 7			
1		Comp. M.	Pattern	C	7	Cover for 2			
	1	Comp. M.	Pattern	C	6	Cover for 1			
1	1	Mica			5	Insulation for 1 & 2			
1		Rainbow Packing			4	Gasket for 2			
	1	Rainbow Packing			3	Gasket for 1			
1		Comp. M.	Pattern	B	2	Box			
	1	Comp. M.	Pattern	A	1	Box	1	May 21 '01	All Fits Parts 6 & 7

	G2	G1	DRAWN O.Van Amburg 4-8-01	BOX, COVER, ETC.
MAY 1			TRACED White Print	FIRST MADE FOR COMBINED JUNCTION BOX & LAMP RECEPTACLE
DATE			INSPECTED Apr. 19, 1901 F. H. R.	M 111098
			GEN. ELEC. CO. SCHENECTADY N. Y.	

Sp. 3152

FIG. 2. EXAMPLE OF DRAWING AND PRESENT ARRANGEMENT OF GROUP TITLE.

Compiled by S. S. Forster
Inspected by J. Kennedy

CONSTRUCTION SPECIFICATION No. 16563

	MACHINE	TYPE	CLASS	FORM	VOLTS
Date Nov. 9 1900	MOTOR	I	4-10-750	M1	220

NAME OF DRG.	DRAWING NO.	SYMBOL, GROUP OR PIECE		NO. OF PARTS	DATE ADDED	DATE CHANGED
		OLD NO.	NEW NO.			
Assembly						
Armature Spider and Flange	85245-402	G. 1				
Armature Winding	T-101827	G. 1			Nov,24,'00	
Arm., Punching and Space Block	97061-437	G. 7				
Base						
Bearing 1¼ x 5¼"	77906-259	BC-101 AR-87	G. 18	2		
Brush-holder	78545-263	AB-337		3		
Brush-holder Yoke	87004-409	G. 2				
Brush-holder Studs and Connections	79850-275	G. 5				
Brush 1¼" x ¾"	73764-263	G. 2		6		
Bolts						
Cable Coupling						
Cables for Armature 64,000 C. M.	82900-298					
Cables for Field 24,000 C. M.	82900-298	54		3	Apr.17,1901	
Connection Board 7¾ x 2½	73432-228	BJ-73		1		
Collector	95287-478	G. 2				
Field Spider	96824-488	G. 2				
Field Spider Shields	96993-438	G. 1				
Field Winding	80232-280	G. 4				
" " Dgm.	92756-468					
Arm. " "	89783-437				Nov,24,'00	
Pulley						
Field Pch. & Space Block	97060-437	G. 3				Feb.15,1901
Rails						
Resistance Details						
Standards and Caps						
Shaft and Keys	M-101765	G. 1			Nov,19,1900	
Short Circuiting Device						
Switch Levers						
Winding Form						
Wooden Base Frame						
Air Gap Gauges	87393-417	5				
Engineering Notices	29099					
Outline	N-101774				Nov,19,1900	
Armature Winding Spec.	A-15229					
Field Winding Spec.	F-13734					

American Machinist

GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y., U. S. A.

FIG. 3. EXAMPLE OF DRAWING LIST.

drawing list the shop foreman places an order for the various drawings given on it in which he is interested, and by instructing his men to make the group called for, the required apparatus is produced. When the workman has the drawing put into his hands he has the whole story of the pieces upon which he is working, instead of having to consult two sheets—a drawing and a specification—and is also able to see what pieces go together, thereby being able to use judgment in the degree of accuracy with which the piece is finished.

Where the work is of such a nature that the detailed specification without the drawing is all that is needed by the men they can get this information either by consulting the titles of the blueprints and ignoring the delineation, or, if this be too clumsy, the titles can be printed by themselves and the various blueprint sheets trimmed to one size, the drawing list being used as a key or index sheet, thus giving the same information as would be given by a separate specification, but making it impossible to change the original of the specification without changing the original of the drawings, because both are the same thing. The writer feels that for many of the uses to which a drawing is put it is highly desirable to give the specification of all the parts on the drawing sheet itself. If this is done, however, it is better not to give it anywhere else, for there is danger that one will be leaned upon as the master record and the other forgotten, and that when changes are made the two specifications will become contradictory.

The Borchardt-Luger Pistol.

Editor American Machinist:

Respectfully referring to a description appearing in No. 20, this year, of your valued journal, concerning the so-called Luger pistol (written by Mr. Grahame H. Powell) I permit myself, on behalf of Herr Hugo Borchardt, engineer, Kurfürstenstrasse, 91, of this city, humbly to communicate the following:

The article referred to contains some fundamental errors, which are likely to prejudice in a certain degree the well-established interests of the above-named gentleman. On the supposition that such an injury naturally has not been intentional on your part, I beg to observe that, in general, every manufacturer has not merely a very material interest but a fundamental right that his form of construction and the products made according to this construction be accompanied with such a designation that the originator of the system is clear and plain. The pistol described in your valuable journal, which is unfairly designated as the "Luger" pistol, pertains in its arrangement unquestionably to the Borchardt system, as indeed is acknowledged in a short notice appearing in another place. In the article itself the pistol is with complete injustice denoted the "Luger" pistol, not only in one but in many places, so that every unprejudiced reader who does not know the facts of the case obtains a false idea. A new Luger system is here treated of, which in fact has no existence. Much more, the pistol refetred to, as already stated, is in its system and its general arrangement utterly and altogether the intellectual property of Herr Hugo Borchardt, whose interests and good right are naturally antagonized when these facts are concealed and a false impression regarding the system created, while indeed there is presented only one of the modified forms of the Borchardt system, later developed from the original form of the same Borchardt pistol.

The author of your article states that the description of the Luger pistol was taken from an exposition on this subject by Major de Meuron in the "Swiss Military Review," and that the Luger pistol has been tested together with others in different countries—for example, in the United States—and has been adopted in Switzerland. On the contrary, let it here and now be emphatically stated that the pistol spoken of in the de Meuron article in the "Swiss Military Review" is solely and explicitly the Borchardt-Luger. Moreover, this pistol is there represented as having been admitted to the tests under the description Borchardt-Luger. In the United States tests also the pistol has figured expressly as the Borchardt-Luger pistol. Doubtless, therefore, it is predjudicial and disfiguring when the author of your article, who, indeed, has made much use of the exposition by de Meuron, speaks exclusively of the Luger pistol. It is as prejudicial as unfair, in so much more as the entire description mentions no essential detail which is not found in the frame of the Borchardt system.

This is especially true, for example, of the arrangement which is designated with so much emphasis as "ingenious" and characteristic solely of the Luger pistol, that the line of sight is covered by the breech mechanism standing open by reason of the exhaustion of the magazine. This arrangement was invented by Borchardt, like all the rest, and protected by patents in his name. It is therefore not subject to invention, and much less can it be spoken of as an arrangement solely of the Luger pistol.

I submit to your courteous consideration an original copy of the de Meuron description, which will serve as proof of the foregoing assertions, and I hope that these references will be sufficient to induce the author of your article to make a suitable correction.

CARL T. BURCHARDT,
Technical and Patent Bureau.

Berlin.

Editor American Machinist:

The writer of the above letter is correct in assuming that no injustice was intended to the interests of Mr. Hugo Borchardt in the description of the automatic pistol in issue No. 20, and while unquestionably the article in the "Swiss Military Review" referred to and described the Borchardt-Luger arm, the pistol was presented to this government for test, whether intentionally or through an oversight, as the "Luger automatic pistol," and has been so known ever since.

As to what part of this arm is the invention of Herr Borchardt there has been no evidence, so far as I am aware, presented to this government.

GRAHAME H. POWELL.

Washington, D. C., July 15, 1901.

Two Shrinkages.

During a visit to a repair shop recently the writer stood by the manager of the concern watching the shrinking of a large steel coupling on to a shaft. The latter, which was hollow, had water running through it from a hose at one end to keep it cool. When the hot coupling was finally in place the hose was withdrawn, and the water was played on the coupling, which was thereby neatly and firmly secured in place. While this work was being performed it was noticed that the machinery in the shop had slowed down, and on inquiry for the cause the manager was informed that the engine shaft had heated up and that the engineer was cooling it off. Our party adjourned to the engine room, where the engineer was seen turning the engine over slowly while he directed a stream of water through the shaft which was hollow. The manager immediately went up to the main bearing of the engine and put his hand on it; its temperature evidently satisfied him that some more radical measures would have to be adopted than those which his engineer was pursuing, so taking the hose from the engineer he turned the water on the bearing itself, and at once shrunk it on to the shaft just as he had shrunk the coupling on to its shaft in the shop a few moments before. The surprise which was depicted on his face when the engine stopped was followed by an expression of anger, and then this narrow and humorless soul expressed his sentiments in language both fluent and ornamental and promptly discharged the engineer. The writer learned afterward that the engine foundation had given way some time previous and that the engineer had repeatedly called the manager's attention to the urgency of necessary repairs. Now what was the mental action that led this man to try to expand metal by the same means that a few moments before he had used to contract it? Perhaps he was trying to emulate the man in the fable who could blow hot and cold with the same breath. It was safe to say, however, that his breath which was hot with expletives was a chilling blast to the engineer.—H. F. J. Porter, before the American Water Works Association.

Thickness of Plates Encastré.

BY GEO. E. BARRETT.

In presenting these formulas I know that I am not giving anything new, but, nevertheless, something that may help those who do not have handy formulas for calculating the thickness of flat plates, such as steam chest and cylinder covers. A few years ago the general formula was given to me by a prominent chief engineer of a large engineering firm, and he told me he had used it on a variety of work and had never been informed of any disastrous results. Since I have had it I have put it to a number of tests and have never been sorry. Practice is the best way to test anything of such nature, and this has had its share, to my knowledge. It is specially useful because of the innumerable shapes it can be applied to and its ease of application. Unwin, in his excellent work on "Machine Design," gives only a few cases of thickness of plates encastré, and very often, in practice, we have odd shapes, such as cylinder covers between ribs.

From the general formula I have deduced expressions for different common outlines, which make its application easier by doing away with dividing the section into triangles.

PRESSURE ON PLATES ENCASTRE MARICHAL.

Let

T = tensile stress on material in pounds per square inch,
t = thickness of plate in inches,
A = area of plate in square inches,
a = area of any triangular section of the plate in square inches,
P = pressure on plate in pounds per square inch,
S = length of section in inches supporting the load on the entire plate,
L = load on any section a,
c = distance in from base of any triangle a to its center of gravity,
M = bending moment of any section a,
ΣM = sum of all the bending moments.

Then

$$M = L\,C \qquad (1)$$

$$T = \frac{3\,\Sigma M}{S\,t^2} \qquad (2)$$

$$t = \sqrt{\frac{3\,\Sigma M}{T\,S}} \qquad (3)$$

Required to find the thickness of a plate A, B, C, D and E, shown in Fig. 1, to support a pressure of 150 pounds per square inch, allowing 5,000 pounds as safe working stress.

First, divide the plate into triangles, as shown by the dotted lines. It should be divided so that each side of the plate will be the base of a triangle and but one side of the triangle will be a supporting edge of the plate.

Graphically I have found the center of gravity of each triangle to be 5 inches for triangle $A\,B\,D$, 1½ inches for $B\,C\,G$, 1½ inches for $C\,D\,G$, 2¾ inches for $D\,E\,F$, 3¼ inches for $A\,E\,F$.

Nearly all the dimensions marked on the sketch have been scaled, as I consider that method sufficient for practice.

Next, find the area of each triangle in square inches, thus: Area

$$A\,B\,D = \frac{18 \times 15}{2} = 135$$

$$B\,C\,G = \frac{8.5 \times 4.25}{2} = 18.0625$$

$$C\,D\,G = \frac{10 \times 4.5}{2} = 22.5$$

$$D\,E\,F = \frac{23 \times 8.375}{2} = 96.3125$$

$$A\,E\,F = \frac{15.81 \times 9.625}{2} = 76.08$$

Multiplying by the value of P we have the load (in pounds) on each triangle: For

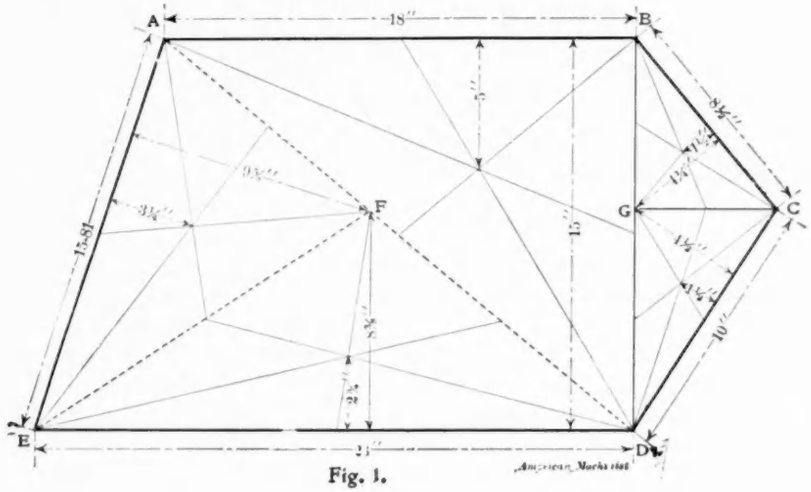


Fig. 1.

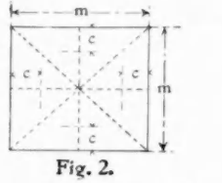


Fig. 2.

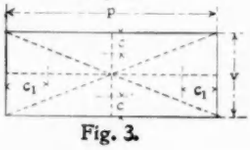


Fig. 3.

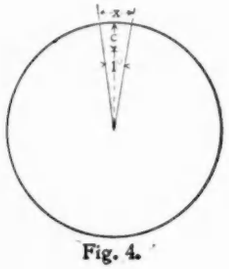


Fig. 4.

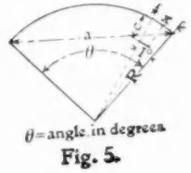


Fig. 5.

THE STRENGTH OF FLAT COVER PLATES.

$$A\,B\,D = 135 \times 150 = 20250$$
$$B\,C\,G = 18.0625 \times 150 = 2709.375$$
$$C\,D\,G = 22.5 \times 150 = 3375$$
$$D\,E\,F = 96.3125 \times 150 = 14446.875$$
$$A\,E\,F = 76.08 \times 150 = 11412$$

Multiplying these loads by the values of c for each triangle gives the moment M. For

$$A\,B\,D = 20250 \times 5 = 101250$$
$$B\,C\,G = 2709.375 \times 1.5 = 4064$$
$$C\,D\,G = 3375 \times 1.5 = 5062.5$$
$$D\,E\,F = 14446.875 \times 2.75 = 38728.92$$
$$A\,E\,F = 11412 \times 3.25 = 37089$$

From Fig. 1 we have:

$$S = 18 + 8.5 + 10 + 23 + 15.81 = 75.31$$

Also

$$\Sigma M = 101250 + 4064 + 5062.5 + 38728.92 + 37089 = 186194.42$$

Substituting these values in formula (3) we have:

$$t = \sqrt{\frac{3 \times 186194.42}{5000 \times 75.31}} = 1.22 \text{ or } 1\tfrac{1}{4}'' \text{ thick.}$$

SQUARE PLATES.

For square plates the formula becomes much simpler. In this case the triangles are all alike, and referring to Fig. 2 for the notation, we have:

$$c = \tfrac{1}{3} \times \frac{m}{2} = \frac{m}{6}$$

The area of each triangle $= \dfrac{m \times \frac{m}{2}}{2} = \dfrac{m^2}{4}$

and we have:

$$L = P\frac{m^2}{4}$$

$$M = P\frac{m^2}{4} \times \frac{m}{6} = \frac{P\,m^3}{24}$$

$$\Sigma M = 4 \times \frac{P\,m^3}{24} = \frac{P\,m^3}{6}$$

$$S = 4\,m.$$

Substituting these values in equation (3) we have:

$$t = \sqrt{\frac{3\,\frac{P\,m^3}{6}}{T \times 4\,m}} = \sqrt{\frac{P\,m^2}{8\,T}} = \frac{m}{2}\sqrt{\frac{P}{2\,T}} \qquad (4)$$

or $$T = \frac{P m^2}{8 t^2} \qquad (5)$$

RECTANGULAR PLATES.

Referring to Fig. 3 for the notation in this case, we have:

$$c = \frac{1}{3} \times \frac{v}{2} = \frac{v}{6}$$

$$c_1 = \frac{1}{3} \times \frac{p}{2} = \frac{p}{6}$$

Area of broad triangle $= \frac{p \times \frac{v}{2}}{2} = \frac{p v}{4}$

Area of narrow triangle $= \frac{v \frac{p}{2}}{2} = \frac{p v}{4}$

And we have:

$$L = \frac{P p v}{4}$$

$$M_1 = \frac{P p v}{4} \times \frac{v}{6} = \frac{P p v^2}{24}$$

$$M_2 = \frac{P p v}{4} \times \frac{p}{6} = \frac{P p^2 v}{24}$$

$$\Sigma M = \frac{2 (P p^2 v + P p v^2)}{24}$$

$$= \frac{P p^2 v + P p v^2}{12}$$

$$S = 2 (p + v)$$

Substituting these values in equation (3) we have:

$$t = \sqrt{\frac{3 \frac{P p^2 v + P p v^2}{12}}{2 T (p + v)}}$$

$$= \sqrt{\frac{P p v}{8 T}} \qquad (6)$$

or $$T = \frac{P p v}{8 t^2} \qquad (7)$$

ROUND PLATES.

In the case of a round plate we imagine the circle divided into 360 equal triangles, which gives a sufficiently small base for good results. In Fig. 4 let

$$x = \frac{\pi d}{360}$$

$$c = \frac{D}{2} \times \frac{1}{3} = \frac{D}{6}$$

$$a = \frac{\pi d^2}{4 \times 360}$$

$$L = \frac{P \pi d^2}{4 \times 360}$$

$$M = \frac{P \pi d^3}{6 \times 4 \times 360}$$

$$\Sigma M = \frac{P \pi d^3}{6 \times 4 \times 360} \times 360$$

$$= \frac{P \pi d^3}{24}$$

$$S = \pi d.$$

Substituting the values in equation (3) we have:

$$t = \sqrt{\frac{3 \frac{P \pi d^3}{24}}{T \pi d}}$$

$$= \frac{d}{2} \sqrt{\frac{P}{2 T}} \qquad (8)$$

or $$T = \frac{P d^2}{8 t^2} \qquad (9)$$

CIRCULAR SECTOR PLATES.

As with the circular plates, we divide the sector into triangles having a base x of 1 degree, and in Fig. 5

$$x = \frac{2 R \pi}{360} \qquad c = \frac{R}{3}$$

$$a = \frac{R x}{2}$$

$$L = \frac{P R x}{2}$$

$$M = \frac{P R x}{2} \times \frac{R}{3} = \frac{P R^2 x}{6}$$

$$\Sigma M = \frac{\theta P R^2 x}{6} = \frac{\theta P R^2}{6} \times \frac{2 R \pi}{360} = \frac{\theta P R^3 \pi}{3 \times 360}$$

$$S = \theta x + 2 R$$

$$= \theta \frac{2 R \pi}{360} + 2 R$$

$$= R (.017 \theta + 2).$$

Substituting the values in equation (3) we have:

$$t = \sqrt{\frac{3 \frac{\theta P R^3 \pi}{3 \times 360}}{T R (.017 \theta + 2)}}$$

$$= \frac{R}{6} \sqrt{\frac{3.14 \theta P}{T (.017 \theta + 2)}} \qquad (10)$$

or $$T = \frac{3.14 \theta P R^2}{360 t^2 (.017 \theta + 2)} \qquad (11)$$

Short Cuts in Computation.

Not long ago I asked a young man who had graduated with distinction at one of our best engineering schools to convert kilograms per square millimeter into pounds per square inch. It was a case of some tensile tests. After a good deal of labor he presented to me the astonishing conclusion that the specimens had broken under a strain of 0.221468 pounds per square inch. You will observe that the precision was great, but that the error was greater. A few weeks ago a boy who had just ended his junior year in an engineering school had occasion to find the fourth power of some 16 or 18 quantities. He proceeded with misapplied industry and by brute force to raise each one of these quantities to the fourth power by the simple process of multiplication. His younger brother suggested logarithms, and the lads eventually got their quantities that way. But even then they did not do their work the quickest and easiest way. They made one separate operation for each quantity instead of tabulating the quantities and grouping the operations. But they might have done even better than this, for the limits of accuracy made it practicable to use a computation table and take out the quantities themselves almost as quickly as they could take out the logarithms. I well remember in my own case the delight with which I discovered, when I had a long column of quantities to compute, that the second difference was constant and that I could get each quantity by the quick and easy process of addition. I should advise you to begin at once to learn the short cuts in computation and also to learn to use your sense as to the accuracy required in each operation, or possible in each operation. You must often have heard of the young engineer who paced the diameter of a circle and then multiplied the diameter by Pi carried to fourteen places of decimals to get the circumference. I have actually known an engineer to design a section of a rail with such precision that he expressed the width of the foot of that rail in six places of decimals.—H. G. PROUT to graduating class of Rensselaer Polytechnic Institute.

Changes of Classification Under the German Tariff.

United States Consul Frank H. Mason writes from Berlin as follows:

"There is a certain snap hook known to the trade in America as the 'Covert snap,' in German as 'Carabiner Haken,' which is made of malleable steel or iron, coated with tin. These have been imported for years under a duty rate of 10 marks ($2.38) per 100 kilograms. The snap hook has a latch in the form of a sliding bolt, which is thrown by a small spiral spring of brass or bronzed wire, wholly concealed within the shank of the hook. Recently, some zealous inspector has dissected one of these snaps, removed the bolt, and discovered the hidden brass spring, which forms perhaps one-fortieth of the whole weight of the article, whereupon the Covert snap has been reclassified as brass goods, dutiable at 24 marks ($5.71) per 100 kilograms (220 pounds), which is said to be practically prohibitory in face of domestic competition.

"Another case of reclassification is that of American ice-cream freezers, which, being superior to anything of similar nature made in Europe, have of recent years found a large and increasing sale in Germany. They are made of wood, hooped, bound and otherwise equipped with iron, and have hitherto been classified for duty as 'ironware in combination with wood' (Eisenwarren in Verbindung mit Holz) and dutiable at 10 marks ($2.38) per 100 kilograms. Recently, however, the same ice-cream freezers have been reclassified as wooden ware in combination with iron, which makes wood the component material of chief value and raises the duty to 30 marks ($7.14) per 100 kilograms. These changes are noteworthy, not because the reclassified duties are abnormally high, but to show the importance to American exporters, before contracting to deliver large quantities of manufactured goods in Germany, of ascertaining by actual trial how they will be classified on passing the German custom-house.

"These sudden changes, and the similar ones which have been previously reported, have had the natural effect of rendering German merchants timid about giving large orders for foreign goods which are necessarily made of several component materials."

Brains Not Appreciated.

Report says that certain officials and employees of the Southern Pacific suffered such severe attacks of "Texas oil fever" that it became necessary for that company to issue an official circular forbidding all employees engaging in other business than that of serving the company. This, of course, will be a shock to those "working men" who, following Mr. Schwab's advice, were attempting to use their brains instead of muscle to lift them to the higher walks of life. The "straw that broke the camel's back" with the Southern Pacific, so the story goes, was the action of a certain official who was sent to the Texas oil fields by the company for the purpose of advancing the interests of the company, but who did not permit the opportunity to pass to advance his own interests. With due respect to the Southern Pacific's interests, the attention of that company is called to the fact that the official who "feathered his own nest" was only availing himself of the opportunity that Mr. Schwab says comes to all "brainy" men.—"Locomotive Firemen's Magazine."

Arrangement of an Electro-Plating Room.

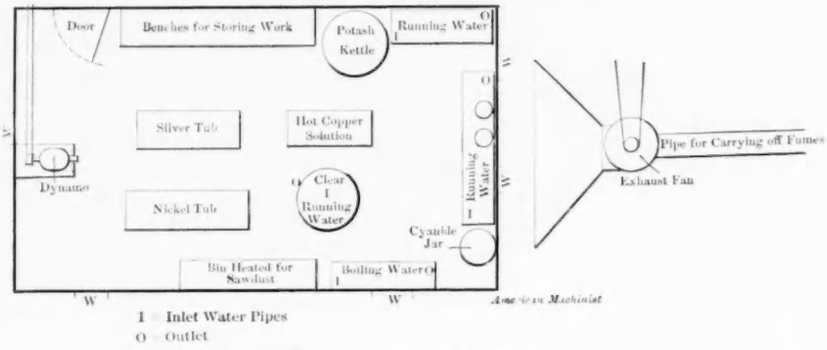
Economical production and convenience in handling work in a plating room call for as many different arrangements as there are kinds of work. This paper will have reference to brass work dipped and plated in nickel and silver, and not buffed either before or after plating. I have found that for economy the arrangement shown in the sketch is most satisfactory. Something about the room will not come amiss here. First, have a good cement floor, if possible sloping toward the center of the room, where there should be a drain pipe to take off the water that is spilt on the floor—and there is always plenty.

The floor should be covered with light wooden racks to keep the feet dry. Then there should be a potash kettle, and one will be more than repaid by getting a big one, round in shape. Use a 1-inch steam pipe to heat with, and there should be a cold water valve over it for convenience in filling. Next, put in the dip tubs; and right here let me say, watch the man that makes those tubs. The sides and bottom should not be less than 2½ inches thick, of the best quality of pine, laid up in white lead and firmly bolted together.

About 30 inches above the tub containing the acid jars put a hood the exact size of the tub, made out of ⅞ pine matched boards. There should be a blower, as per sketch, which will remove acid fumes and improve the work.

The vat for the boiling water should be of wood heated with steam in brass and copper pipes to avoid rust. Have the clear running water in an iron tank with a ½-inch inlet and a 1-inch overflow pipe. Valves should be put in over the hot water so that, as it evaporates, it may be easily filled. Let the dynamo be 4 or 5 feet from the floor, so that the plater can get at the brushes and properly adjust them.

With this arrangement the plater gathers up his work on the bench, goes from potash to running water then to dip tub,



ARRANGEMENT OF AN ELECTRO-PLATING ROOM.

dips, rinses work, puts it through cyanide jar, then in round water tank, next nickel tub, plates, rinses in round water tank, then in boiling water, and lastly drys it in the saw-dust bin. This arrangement reduces the walking to a minimum, which is quite an item when one travels the road around those tubs nine hours a day and six days a week.

When putting in all overflow pipes use lead. Don't have any iron pipes where the acid runs out in the water, as they will last but a few days, while the lead will ordinarily last two years.

Now to fill up the tubs. First write down in a note book the following formula: Into an 8-gallon jar standing in the dip tub put: Aqua fortis, 40 degrees, 4 gallons; water, 2 gallons. This is the firing-off dip. Into the other 8-gallon jar put: Aqua fortis, 40 degrees, 2 gallons; oil vitriol, 66 degrees, 4 gallons; water, 1 gallon. This is the bright dip; be sure and keep iron out of it.

Into a 12-gallon jar put 10 pounds cyanide of potassium C. P. and 10 gallons boiling water to make the cyanide dip. For the nickel solution, dissolve in boiling water nickel salts until the hydrometer stands at about 8 degrees Beaume when cool; put in the nickel tub, hang on the anodes, connect up the wires and let the solution stand twenty-four hours.

Don't have a zinc pail around the tub, or in the room for that matter, as it will make trouble surely.

Now as to working the solution. Provide first some blue and red litmus paper with which to test the solution. It should always be neutral, or nearly so, a trifle acid rather than alkaline. Dip the work as bright as possible, and for the cheaper classes of brass work run twelve minutes, rinse in cold water, then in boiling water and dry in the hot saw-dust.

Don't get potash or soap or cyanide or anything but water in the nickel, and with a little practice and lots of patience one will have very little trouble in turning out work which is good and also cheap. In the future, when I get my new room started, I will write something about the electrical equipment, switches, wiring, etc., and explain why we built our own switchboards and where we made a great mistake. "IRONQUILL."

The Courage of the Engineer.

The one most precious quality is courage. Your best work, your only large work, must be done alone. You will use the skill, the learning and the wisdom of other men. That you must do if you are to go far, for there are hard and fast physical limits to what one man can do. But the constructive work, the organizing work, you must do alone. You will find that when the great solemn situations arise you must retire within yourselves and brood over them; you will find that in those situations no one can really help you much. You will find that ultimately you must rely on yourselves and on yourselves alone, and this takes courage. It often seems to me that one of the marks of genius is the capacity to retire and meditate. Surely one of the marks is self-reliance. If I were asked to name the greatest work ever done by man since he walked the earth I should not hesitate an instant; I should say that it is the Hebrew Scriptures. Nothing else has so profoundly influenced mankind, or so widely or in so many ways. But who produced the Hebrew Scriptures? Not the men who dwelt in the ports where the tides of commerce and travel flow; not the men who dwelt in cities; but the men who lived in the wilderness, on the great arid plains—the men who sat apart in vast solitudes, and to whom Nature herself was an enemy. It seems to me that this is a grand example of a truth that shines through all human history—that the constructive powers must work alone, that inspiration must be from within. This is what I have in mind when I come back again and again to the saying—courage and again courage, and always courage.—COL. H. G. PROUT, to the graduating class of the Rensselaer Polytechnic Institute.

The Sirocco Fan.

We reproduce from "The Engineer," London, some illustrations of a fan which embodies a radical and successful departure from the familiar type of centrifugal fan; the description of the fan and information concerning it we condense from the same source.

The most noticeable feature of difference from the common type of fan is in the shape, size and number of blades employed. The number of blades in the 30-inch fan here shown is sixty-four, and a curious feature is that over a large range of sizes of fans this particular number of blades seems to give the best results. The blades are very short radially, being only one-sixteenth of the diameter of the fan deep; but axially they are three-fifths of the diameter, or 18 inches long. The outer edges of the blades are bent forward, to a set angle, in the direction of rotation, and at one end they are slightly cupped. The inlet and outlet of the fan are approximately of equal area to that of the fan itself. It is claimed that the special form of blade employed and its special size and shape do away almost entirely with the detrimental and power-absorbing eddies which are so frequent with a number of other fans. Moreover, it is further claimed that the velocity of the air as it is discharged from the Sirocco fan is greatly accelerated, so much so that it actually exceeds the peripheral speed of the blades by as much as 80 per cent. The intake draught of the fan is wonderfully regular, practically not varying over the whole area of the intake. It is just as though a solid cylinder of air were being drawn bodily in.

The drawing, Fig. 3, shows the method of fastening the fan blades and one of the types of bearing employed. This bearing is centrally supported within a cylindrical bracket, which in turn is held in position by an arrangement of tension rods. This style of bearing is found to work well in this fan, without water jacket and with no special oiling arrangements, when the fan is used for exhausting the products of combustion, say, from boiler furnaces, where of course a high temperature is encountered.

This fan has reached its present excellence almost entirely as a result of a long series of experiments most carefully recorded, rather than by any sudden invention. The method of procedure has been to experiment in every direction promising good results, and these researches have been continued to where further advantage ceased to be attained. Thus a practicallly hard and fast rule of size and form could be laid down, and not until then were the dies and jigs and templets made.

Now that these particulars have been determined, a number of special tools have been devised for the correct and economical production of the fans. The blades are punched out of sheet metal in a stamping machine, and another stamping in another special machine gives them the proper curvature and turns up the ends for riveting. Another specially designed tool is used for ensuring that the rotary member is true. It consists of a number of radial arms carrying clamps which hold the rings to which the blades are riveted. Another tool automatically drills the holes in the rings. All the angle-irons, plates, etc., are bent cold in another special machine. Still another device used in assembling assures the absolute accuracy of the bearing. A large number of special tools have thus been constructed, all designed by the inventor of the fan, Mr. S. C. Davidson.

Tests of these fans show astonishing results which it is not necessary here to recapitulate. A most noticeable fact is the immense amount of air which they are capable of delivering as compared with other fans, and they have been tested most

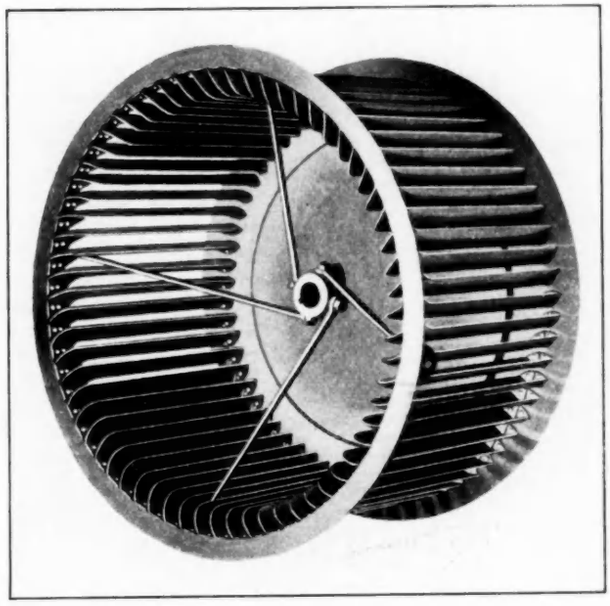


FIG. 1. ROTATING DRUM OF THE SIROCCO FAN.

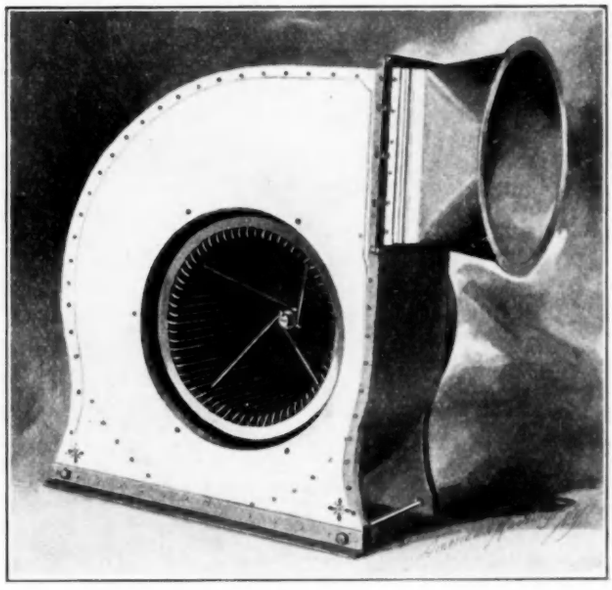


FIG. 2. THE SIROCCO FAN.

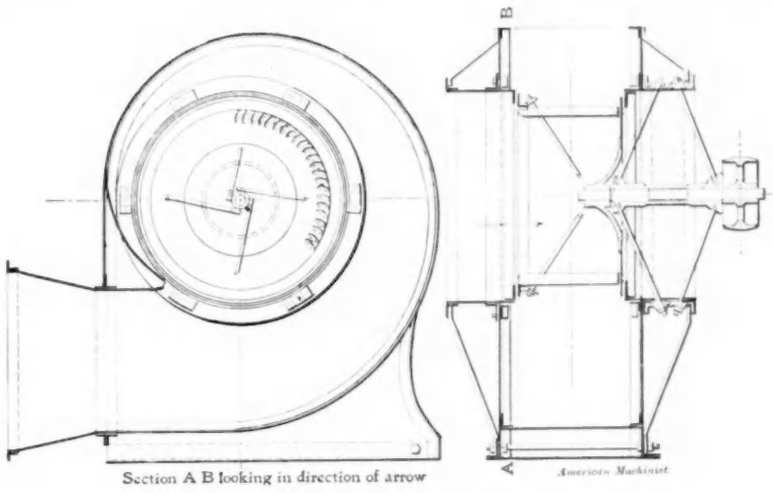


FIG. 3. SECTIONS OF THE SIROCCO FAN.

thoroughly with the best known makes of fan. Efficiencies are reported for this fan ranging from 92 to 96 per cent. as compared with the theoretical power required to move the given volume of air at the given velocity. These fans are built by Davidson & Co., Limited, Belfast, Ireland.

Hydrodynamometers.

BY R. GRIMSHAW.

This is a word coined by the French to express a dynamometer in which hydraulic pressure replaces metal springs for resisting and measuring the torsion or other force exerted in transmission, without absorbing it as the Prony brake.

The water-dynamometer or hydrodynamometer here described is peculiarly adapted to measuring the torsion or rotative effect of marine shafts and the lengthwise push on them exerted by the screw which they drive. This is especially valuable in enabling comparative experiments to be made with different types and forms of screw propellers.

In carrying out these experiments, Monsieur H. Bouron has devised two special apparatuses—a hydrodynamic bearing and a hydrodynamic shaft coupling or "hydrodynamometer."

In the former, the thrust of the screw is measured by water pressure instead of by spring flexion. Such a hydrodynamic bearing is shown in Figs. 1 to 5, taken from "Le Génie Civil." Fig. 1 gives a lengthwise view, Fig. 2 two half cross-sections, and Fig. 3, above, a half-horizontal axial section and, below, a half view in plan. Fig. 4 is a rear view, and Fig. 5 a general view of the device as installed on the 1,000-ton steamer "Nantes-Le Havre."

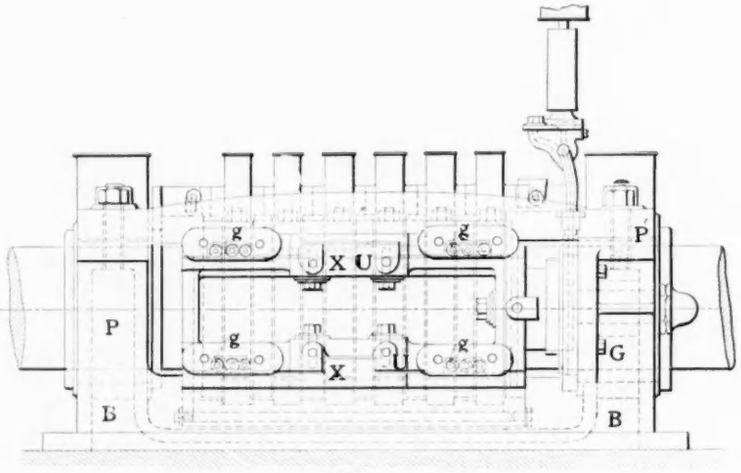


Fig. 1

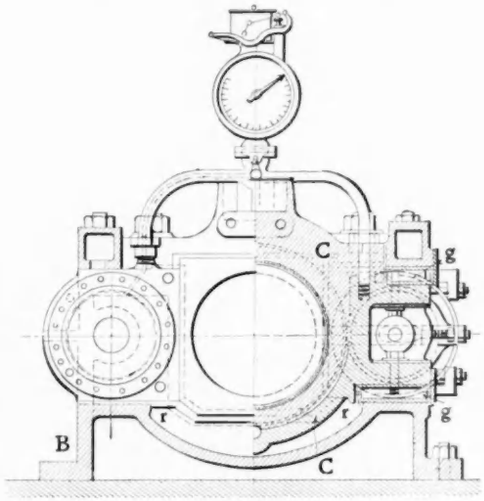


Fig. 2

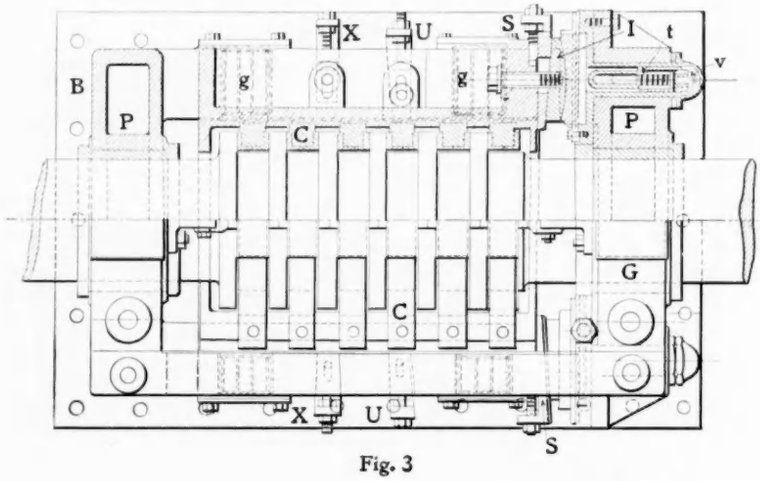


Fig. 3

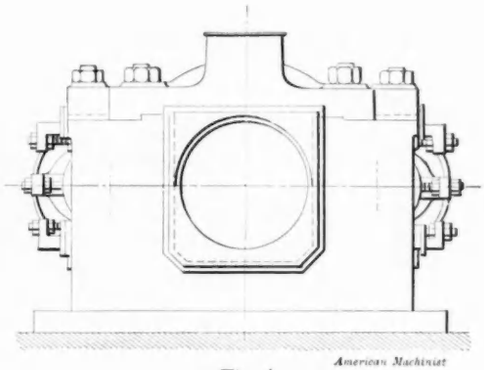


Fig. 4

HYDRODYNAMIC BEARING.

It will be seen that this is at once a thrust bearing and transmission dynamometer. If we suppose an end pressure of 100 metric tons, and want to limit our water pressure to 50 kilograms per square centimeter (that is, to about 750 pounds per square inch), there is needed only 2,000 square centimeters of resisting surface (say, roughly, 320 square inches), which can be got by two pistons, each of 36 centimeters, or say 14½ inches, diameter. The incompressibility of the liquid calls for but a short stroke—in this case only 5 to 6 millimeters, or less than ¼ inch of cylinder depth, and 0.02 millimeter of actual displacement.

Referring to the illustrations, *C* are grooved rings which receive the thrust of the shaft rings and which have a slight lengthwise motion on the frame *B*, which is bolted to the frame of the ship. To lessen friction there are ordinary bearings *P P'* at each end of the thrust bearing. Eight groups each of three sets of rollers *g g* are placed between the frame and the friction rings on thrust rings, and the guides *r* keep all in line lengthwise. The wedges S enable the exact adjustment of the pistons; in starting out, the rings are brought "chock a block" by the wedges *X* and *U*.

The pistons *I* press on an elastic diaphragm which forms one side of the water chamber. At *t* is a piston which can be moved by the screws *v*, to vary the capacity of the water chamber. The lengthwise piece *L*, uniting the two bearings *P P'*, helps guide the thrust rings and stiffen the whole structure. Registering devices for the pressure are of course readily applied.

Where the tonnage of the vessel re-

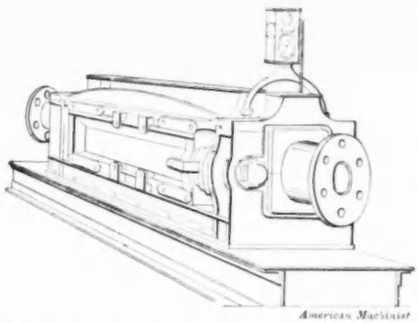


FIG. 5. PERSPECTIVE VIEW OF HYDRODYNAMIC BEARING.

mains practically constant these registers would give an idea of the speed at any time.

The hydrodynamometer which measures the rotative effect is in fact a hydraulic shaft-coupling, on the same principle as the thrust bearing—which latter is also of course, in one sense, a hydrodynamometer.

It is shown in Figs. 6 and 7, as applied to measure the force transmitted by the

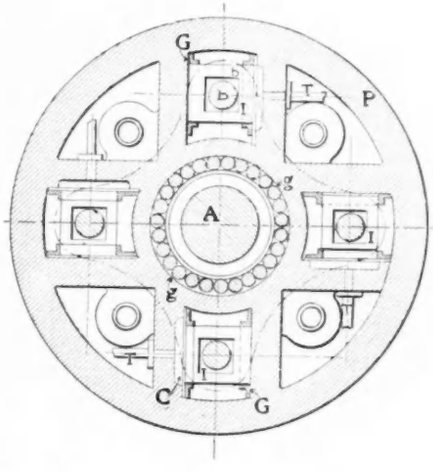
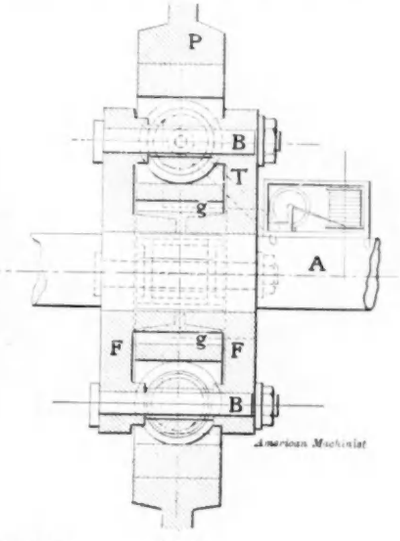


FIG. 6.



HYDRODYNAMOMETER. FIG. 7.

shaft A to the pulley P. There are keyed on the shaft two flanges $F F'$, united by four bolts B which bear the sliding pieces b and through these latter the pistons I, which play in bores C made in the pulley P. Although this latter can have but slight rotary movement with relation to the shaft A, anti-friction rollers g are interposed between them. The pistons are guided by the bores of their chambers or cylinders and by guides G.

The arrangement of the cylinders or chambers C is the same as on the thrust bearing or thrust dynamometer; four tubes T communicate with a registering device mounted on the shaft and turning therewith.

Similar arrangements permit measuring the torsion transmitted by one shaft section to another.

[The rotary dynamometer will be recognized as essentially the same device as the one designed some years ago by Professor Flather. It is interesting to know that it has been applied to the measuring of such large forces as those involved in ship propulsion. The thrust dynamometer is, we believe, new, and the two in combination are obviously capable of extended usefulness.—Ed.]

Letters from Practical Men

The Action of the Valve Gear in the Otis Elevator.

Editor American Machinist:

With much interest I read in issue No. 26 the article about the Otis double power hydraulic elevator, and I hope the writer will not take offense at my criticism.

In explaining the action of the operating valve, he says, in regard to Fig. 1, that friction of w holds the same in place, while the pilot valve lever b is being moved off center.

Such is not the case. The main valve is prevented from moving upward by the water enclosed between w and the pilot valve, and in order to move the main valve downward, the force to be overcome is equal to the product of the unbalanced area of the valves v and w multiplied by the low pressure plus the product of the area of valve v times the atmospheric pressure, if the exhaust water is (as usual) discharged into the open tank.

ANDERSEN.

Some Piston Experience.

Editor American Machinist:

On page 153 Mr. J. G. tells of some packing-ring experience. I was formerly with a firm whose main work was steam engines and repairs. We frequently found that the breaking of piston rings was caused more by their location in the piston than by any weakness at the joint. Where rings travel too far over the counterbore the steam on admission strikes them suddenly, causing a snap, and as this happens every stroke it soon tells on the rings and frequently results in breakage. Where two rings are used they should be placed so close to the center of the piston that their travel will be up to, but not over, the counterbore.

Fig. 1 shows the type of piston we used from 14 inches diameter up. On first acquaintance with this style, some people object to it on account of its single packing ring, fearing that it will wear shoulders in the cylinder by not traveling over the counterbore. This might result if very stiff springs were used, but with the piston a good fit in the cylinder and water grooves in addition, as shown at $a\,a$, very little spring force is needed, and when after years of use shoulders do appear they are, in horizontal engines, only on the top, and their removal, while unhandy, is not difficult.

Large pistons are made so that they can be adjusted for hight and the bull ring is babbitted as at Fig. 2. This metal when cooling has a tendency to shrink towards the center, and, it being impossible to tighten it by hammering, the dovetail in the center of the groove is provided and the babbitt tightens itself on this while

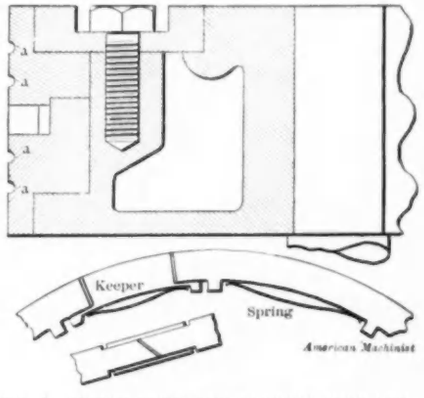


FIG. 1. PISTON WITH ONE PACKING RING AND RENEWABLE WEARING SURFACE.

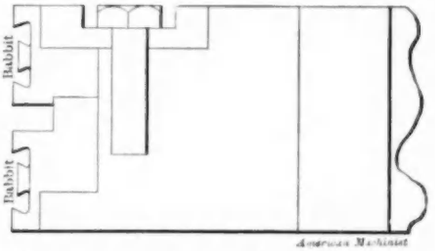


FIG. 2. PISTON WITH BABBITTED WEARING SURFACES.

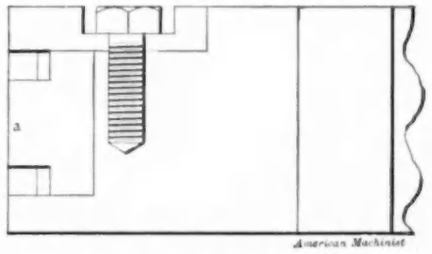


FIG. 3. A COMMON TYPE OF PISTON.

FRACTIONS, AREAS, POWERS ETC.

	DEC. EQUIV.	AREA	CIR.	SQUARE	CUBE	4TH. POWER
1-64	.015625	.00019	.04909	.000244	.0000038	.0000006
1-32	.03125	.00077	.0982	.000977	.0000305	.0000009
3-64	.046875	.00173	.1473	.002197	.0001030	.0000048
1-16	.0625	.0031	.1963	.003906	.0002441	.0000152
5-64	.078125	.0048	.2454	.006104	.0004768	.0000372
3-32	.09375	.0069	.2945	.008789	.0008240	.0000771
7-64	.109375	.0094	.3436	.011963	.0013084	.0001430
1-8	.125	.0123	.3927	.015625	.0019531	.000244
9-64	.140625	.0155	.4418	.019775	.002781	.0003908
5-32	.15625	.0192	.4909	.024414	.003815	.0005954
11-64	.171875	.0232	.5400	.029541	.005077	.0008702
3-16	.1875	.0276	.5890	.035156	.006592	.001232
13-64	.203125	.0324	.6381	.041260	.008381	.001697
7-32	.21875	.0376	.6872	.047852	.010468	.002284
15-64	.234375	.0431	.7363	.054932	.012875	.003014
1-4	.25	.0491	.7854	.0625	.015625	.003906
17-64	.265625	.0554	.8345	.070557	.018742	.004970
9-32	.28125	.0621	.8836	.079102	.022247	.006256
19-64	.296875	.0692	.9327	.088135	.026165	.007762
5-16	.3125	.0767	.9817	.097656	.030518	.009530
21-64	.328125	.0846	1.0308	.107666	.035328	.01158
11-32	.34375	.0928	1.0799	.118164	.040613	.01395
23-64	.359375	1014	1.1290	.129150	.046413	.01668
3-8	.375	.1104	1.1781	.140625	.052734	.01977
25-64	.390625	.1198	1.2272	.152588	.059605	.02328
13-32	.40625	.1296	1.2763	.165039	.067047	.02723
27-64	.421875	.1398	1.3254	.177979	.075085	.03165
7-16	.4375	.1503	1.3744	.191406	.083740	.03663
29-64	.453125	.1613	1.4235	.205322	.093037	.04215
15-32	.46875	.1726	1.4726	.219727	.102997	.04837
31-64	.484375	.1843	1.5217	.234619	.113644	.05504
1-2	.5	.1963	1.5708	.25	.125	.0625

	DEC. EQUIV.	AREA	CIR.	SQUARE	CUBE	4TH. POWER
33-64	.515625	.2088	1.6199	.265869	.137089	.07071
17-32	.53125	.2217	1.6690	.282227	.149933	.07963
35-64	.546875	.2349	1.7181	.299072	.163555	.08946
9-16	.5625	.2485	1.7671	.316406	.177979	.10011
37-64	.578125	.2625	1.8162	.334229	.193226	.11169
19-32	.59375	.2769	1.8653	.352559	.209320	.12491
39-64	.609375	.2916	1.9144	.371338	.226284	.13791
5-8	.625	.3068	1.9635	.390625	.244141	.15256
41-64	.640625	.3252	2.0126	.410400	.262913	.16842
21-32	.65625	.3382	2.0617	.430664	.282623	.18546
43-64	.671875	.3545	2.1108	.451416	.303295	.20376
11-16	.6875	.3712	2.1598	.472656	.324951	.22340
45-64	.703125	.3883	2.2089	.494385	.347614	.24438
23-32	.71875	.4057	2.2580	.516602	.371307	.26688
47-64	.734375	.4236	2.3071	.539307	.396053	.29084
3-4	.75	.4418	2.3562	.5625	.421875	.31641
49-64	.765625	.4602	2.4048	.586182	.448795	.34357
25-32	.78125	.4794	2.4544	.610352	.476837	.3721
51-64	.796875	.4987	2.5030	.635010	.506023	.4032
13-16	.8125	.5185	2.5525	.660156	.536377	.4356
53-64	.828125	.5387	2.6011	.685791	.567921	.4704
27-32	.84375	.5591	2.6507	.711914	.600677	.5069
55-64	.859375	.5796	2.7017	.738525	.634670	.5456
7-8	.875	.6013	2.7499	.765625	.669922	.5861
57-64	.890625	.6228	2.7960	.793213	.706455	.6292
29-32	.90625	.6450	2.8471	.821289	.744293	.6750
59-64	.921875	.6675	2.8965	.849854	.783459	.7225
15-16	.9375	.6903	2.9452	.878906	.823975	.7725
61-64	.953125	.7131	2.9939	.908447	.865864	.8248
31-32	.96875	.7371	3.0434	.938477	.909149	.8798
63-64	.984375	.7610	3.0913	.968994	.953854	.9385
1	1.0	.7854	3.1416	1.0	1.0	1.0000

	DEC. EQUIV.	AREA	CIR.	SQUARE	CUBE	4TH. POWER
1	1.0	.7854	3.14159	1.0	1.0	1.0
1-32	1.03125	.83525	3.2398	1.0635	1.0967	1.13
1-16	1.0625	.88664	3.3379	1.1289	1.1995	1.27
3-32	1.09375	.93956	3.4361	1.1963	1.3084	1.43
1-8	1.125	.99402	3.5343	1.2656	1.4238	1.60
5-32	1.15625	1.05	3.6325	1.3369	1.5458	1.78
3-16	1.1875	1.1075	3.7306	1.402	1.6746	1.98
7-32	1.21875	1.1666	3.8288	1.4854	1.8103	2.20
1-4	1.25	1.2272	3.9270	1.5625	1.9531	2.45
9-32	1.28125	1.2893	4.0252	1.6416	2.1033	2.69
5-16	1.3125	1.3530	4.1233	1.7227	2.2610	2.97
11-32	1.34375	1.4182	4.2215	1.8057	2.4264	3.26
3-8	1.375	1.4849	4.3197	1.8906	2.5996	3.57
13-32	1.40625	1.5532	4.4179	1.9775	2.7809	3.91
7-16	1.4375	1.6230	4.5160	2.0664	2.9705	4.27
15-32	1.46875	1.6943	4.6142	2.1572	3.1684	4.65
1-2	1.5	1.7671	4.7124	2.25	3.375	5.06
17-32	1.53125	1.8415	4.8106	2.3447	3.5904	5.47
9-16	1.5625	1.9175	4.9087	2.4414	3.8147	5.95
19-32	1.59375	1.9949	5.0069	2.5400	4.0482	6.45
5-8	1.625	2.0739	5.1051	2.6406	4.2910	6.97
21-32	1.65625	2.1545	5.2033	2.7432	4.5434	7.50
11-16	1.6875	2.2365	5.3014	2.8477	4.8054	8.07
23-32	1.71875	2.3201	5.3996	2.9541	5.0774	8.70
3-4	1.75	2.4053	5.4978	3.0625	5.3594	9.38
25-32	1.78125	2.4920	5.5960	3.1729	5.6516	10.05
13-16	1.8125	2.5802	5.6941	3.2852	5.9543	10.76
27-32	1.84375	2.6699	5.7923	3.3994	6.2677	11.56
7-8	1.875	2.7612	5.8905	3.5156	6.5918	12.4
29-32	1.90625	2.8540	5.9887	3.6338	6.9269	13.2
15-16	1.9375	2.9483	6.0868	3.7539	7.2732	14.1
31-32	1.96875	3.0442	6.1850	3.8760	7.6308	14.9

	DEC. EQUIV.	AREA	CIR.	SQUARE	CUBE	4TH. POWER
2	2.0	3.1416	6.2832	4.0	8.0	16.0
1-16	2.0625	3.3410	6.4795	4.2539	8.7737	18.1
1-8	2.125	3.5466	6.6759	4.5156	9.5957	20.4
3-16	2.1875	3.7583	6.8722	4.7852	10.4675	22.9
1-4	2.25	3.9761	7.0686	5.0625	11.3906	25.6
5-16	2.3125	4.2000	7.2649	5.3477	12.3665	28.6
3-8	2.375	4.4301	7.4613	5.6406	13.3965	31.8
7-16	2.4375	4.6664	7.6576	5.9414	14.4822	35.3
1-2	2.5	4.9087	7.8540	6.25	15.625	39.1
9-16	2.5625	5.1572	8.0503	6.5664	16.8264	43.0
5-8	2.625	5.4119	8.2467	6.8906	18.0879	47.5
11-16	2.6875	5.6727	8.4430	7.2227	19.4109	52.1
3-4	2.75	5.9396	8.6394	7.5625	20.7969	57.2
13-16	2.8125	6.2126	8.8357	7.9102	22.2473	62.6
7-8	2.875	6.4918	9.0321	8.2656	23.7637	68.3
15-16	2.9375	6.7771	9.2284	8.6289	25.3474	74.5
3	3.0	7.0686	9.4248	9.0	27.0	81.0
1-8	3.125	7.6699	9.8175	9.7656	30.5176	95.4
1-4	3.25	8.2958	10.210	10.5625	34.3281	112.0
3-8	3.375	8.9462	10.603	11.391	38.443	130
1-2	3.5	9.6211	10.996	12.25	42.875	150
5-8	3.625	10.321	11.388	13.141	47.635	173
3-4	3.75	11.045	11.781	14.062	52.734	198
7-8	3.875	11.793	12.174	15.016	58.186	225
4	4.0	12.566	12.566	16.0	64.0	256
1-8	4.125	13.364	12.959	17.016	70.189	290
1-4	4.25	14.186	13.352	18.062	76.766	326
3-8	4.375	15.033	13.744	19.141	83.740	366
1-2	4.5	15.904	14.137	20.25	91.125	410
5-8	4.625	16.800	14.530	21.391	98.932	458
3-4	4.75	17.721	14.923	22.562	107.172	509
5	5.0	19.635	15.708	25.0	125.0	625

F.W.N. DEC. 3, 1900.

the outside edges are closed by a roller tool in the lathe after turning it nearly to size.

Fig. 3 shows a type of piston often met with. Should it become necessary to raise the piston (to bring the rod central) the whole wear due to its weight is shown on the portion *a* of the bull ring, while in Figs. 1 and 2 the whole wearing surface of the piston is retained regardless of adjustment. We always place packing-ring joints on the bottom, the reason for which is that the piston by its weight makes a joint with cylinder itself there, the ring doing this around the sides and top.

ERECTOR.

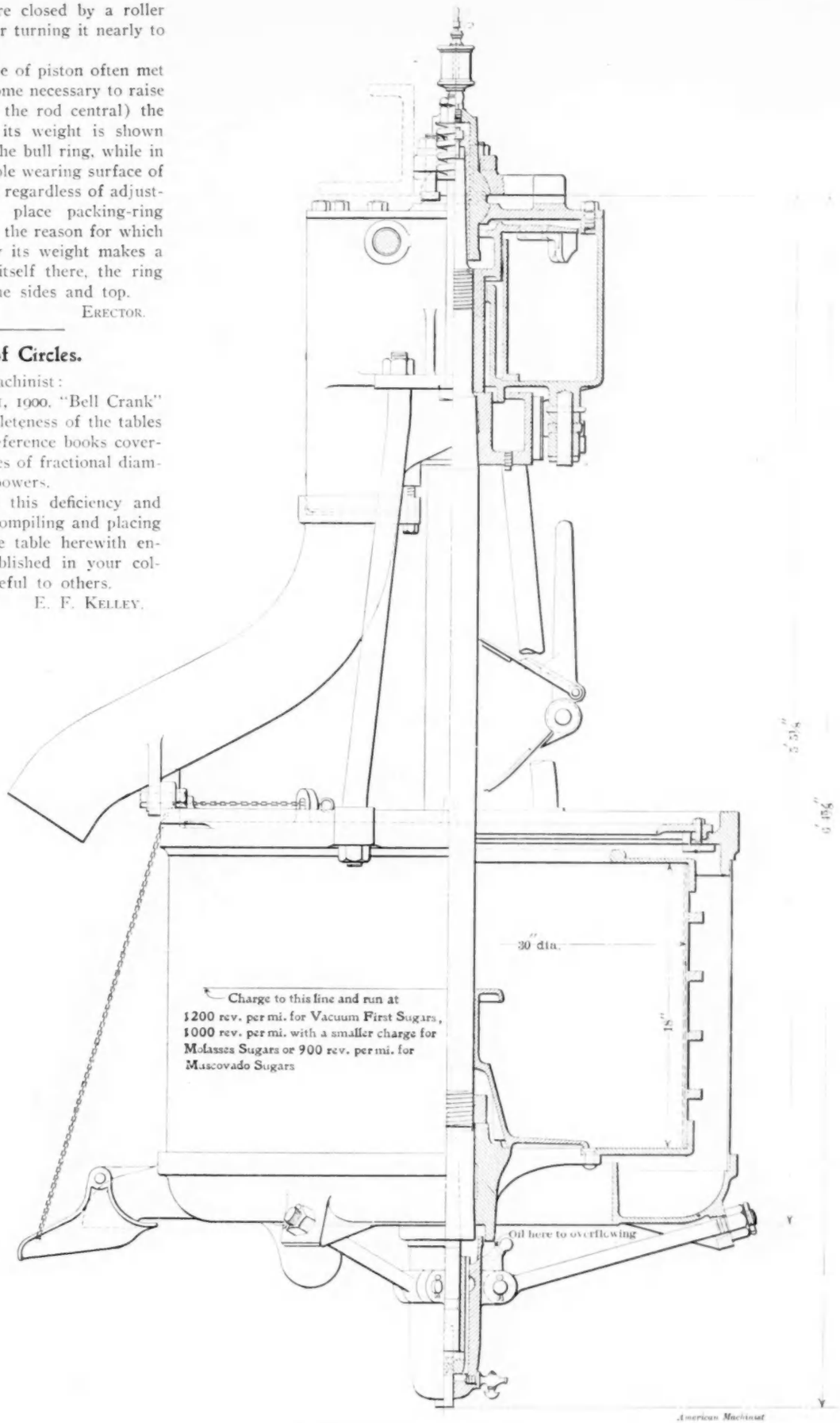
Tables of Circles.

Editor American Machinist:

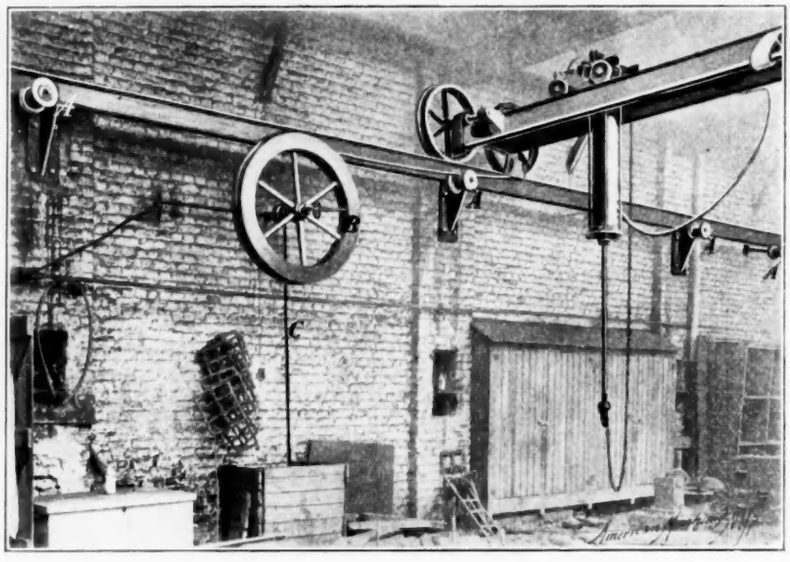
In the issue No. 51, 1900, "Bell Crank" speaks of the incompleteness of the tables to be found in the reference books covering the areas of circles of fractional diameters and fractional powers.

I have also noted this deficiency and have supplied it by compiling and placing in my note book the table herewith enclosed, which, if published in your columns, may prove useful to others.

Bath, Me. E. F. KELLEY.


30" dia.
Charge to this line and run at
1200 rev. per mi. for Vacuum First Sugars,
1000 rev. per mi. with a smaller charge for
Molasses Sugars or 900 rev. per mi. for
Muscovado Sugars
Oil here to overflowing
American Machinist

WATER-DRIVEN 30-INCH CENTRIFUGAL.



ARRANGEMENT OF HOSE FOR A TRAVELING AIR HOIST.

Arrangement of Hose for a Traveling Air Hoist.

Editor American Machinist:

The enclosed photograph shows an arrangement in use in our foundry whereby a hose 10 meters long is made to serve a traveling crane having a traverse of 20 meters.

Wood rolls *A* for the support of the hose are placed at suitable intervals along the wall. A sheave *B*, at the center of the crane track, acts as a hose reel, the hose being wound up as the crane approaches the reel by a weight of 20 kilogrammes hung from a cable *C*, which is wound on a small drum attached to the reel. It will be observed that with a hose 10 meters long the crane may go that distance each side of the reel.

This method was used in this case because the foundry, at this point, is rather low, which made the plan shown in our previous letter inadmissible.

ARTHUR BOLLINCKX.

Brussels, Belgium.

[We infer that the air is carried to the hose through a hollow shaft supporting the reel—this shaft being in turn connected to the pipe shown on the wall.—Ed.]

Making a Casting Without a Pattern.

Editor American Machinist:

I send herewith a photograph, Fig. 1, of a casting and what was used to mold it. As but one casting was required, we reduced the pattern expense as much as possible. The casting, seen at the left, was a ring of peculiar shape. Fig. 2 shows it in section. Four of the cores from the inner portion of the large core box made the inside of the ring, and four of the cores from the outer portion of the same box made the outside of the ring. The cores from the small flat box cut out the inside corner of the ring. All shaping and fitting were done on the buzz and band saws, perfect joints not being necessary for the little use made of the core boxes. With the sketch, Fig. 2, which was sent to the foundry, the method should be easily understood. J. L. GARD.

A Casting, the Flask and the Molding.

Editor American Machinist:

When visiting a large foundry some years ago, I noticed particularly a certain casting which was then being molded in the floor. This casting was of box form, and the section of metal was very thin; the aim being to produce as light a casting as possible. The sizes were 2 feet 4 inches long by 1 foot 4 inches wide, and 1 foot 4 inches deep. Numerous facings and slot cores were distributed over the sides and ends of the pattern, so that both sides and ends had to be removed before drawing the pattern off the core, and also to facilitate the placing of numerous cores and to finish the mold.

The method employed at that time was to slide the side and end cheeks back from the pattern by means of bars upon which the cheek plates rested. This, however, was found to be a very uncertain way of working, and numerous wasters were the result, quite 50 per cent. being bad, either through the castings being misrun, through the sides of the mold being rammed into the thickness, or through the straining of the sides, causing much too heavy a casting. A first-class floor molder was two

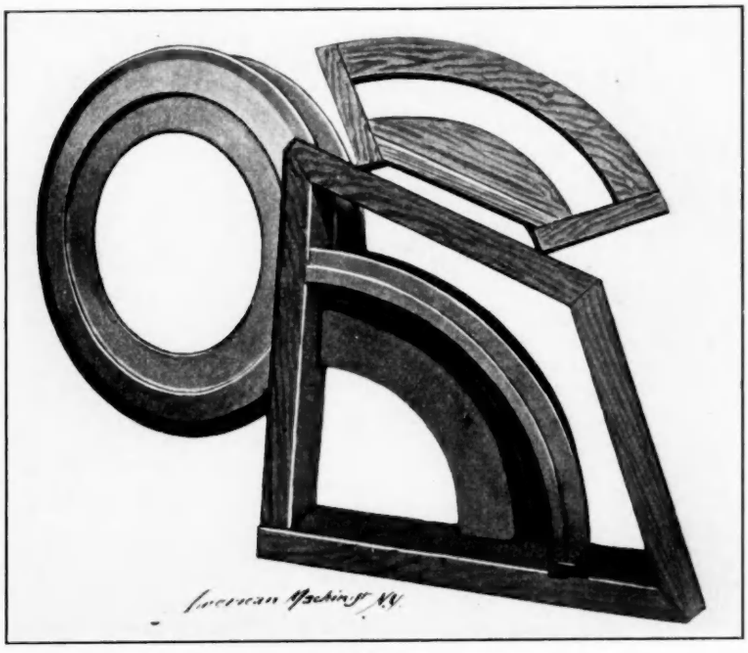


FIG. 1. A CASTING AND THE CORE BOXES FOR MAKING IT.

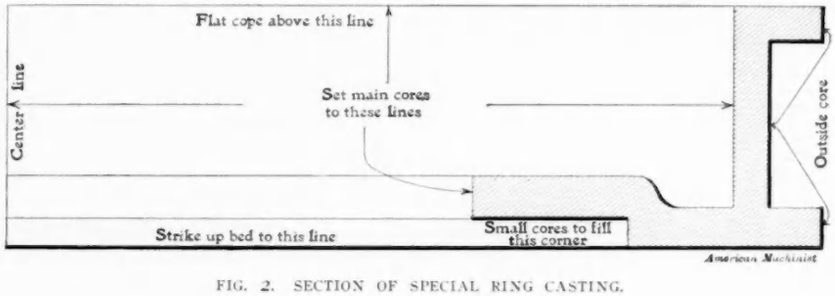

Flat cope above this line
Center line
Set main cores to these lines
Outside core
Strike up bed to this line
Small cores to fill this corner
American Machinist

FIG. 2. SECTION OF SPECIAL RING CASTING.

full days in getting one mold ready for pouring.

A few weeks ago I had occasion to visit this shop again, so I looked around for that box pattern, and I also inquired how they were working it. I found that a special flask had been designed for molding this pattern, with hinged sides and ends. Fig. 1 is a sketch, from memory, of the flask, with the top part lifted off and all four sides cottered up. Fig. 2 shows a side and end let down, and the corner pillars in position for securing the hinged sides and ends in their exact positions.

In molding, the pattern is set on four corner stands or stools, fastened in the flask, as in the section, Fig. 3. The inside or core is first rammed up. Inside the core a perforated cast-iron box is fixed, leaving 3 inches of sand around the sides of the core, and also on the top, as in the section. The top plate of the pattern is loose, and is put back in its place when the core is filled. When tucking the core the outside cheeks are cottered up tight. They are now let down and the joint is formed around the bottom edge of the pattern. The cheeks are now cottered tight again, and all four cheeks are rammed up together, no side joints being formed; the flask being so arranged as to form the four corner joints very well.

Fig. 4 is a plan of a corner of the flask enlarged, showing how the joint is formed. The knife edges on each cheek meet each other and come to within ⅛ inch of meeting the corners of the pattern. After the pattern is drawn and the mold is finished, the sides are shut back to their exact positions, and the space behind the joint *P*, Fig. 4, is filled with dry parting sand. The castings made in this flask are uniform in weight, the number of wasters is almost *nil*, and the time occupied in molding a single box is four hours.

GEORGE BUCHANAN.

Wrexham, North Wales.

Small Photographic Prints from Tracings.

Editor American Machinist:

It became necessary some time ago for me to devise some means of obtaining in very compact form prints from a lot of tracings, and thinking the method, which is very cheap and rapid, might interest those who may wish to keep reduced prints of their tracings in fireproof vaults, or to use them in making up notes, I send it to you.

I used a 5x8-inch camera fitted with a Darlot Rectilinear lens of great depth of focus, though it is obvious any rectilinear lens may be used. No dry plates are necessary. The prints are made direct on "glossy velox," and the tracings are "reduced" from any size tracing to any size print, either or neither of which may be standard. The tracing is hung in a window, preferably of northern exposure, with the face of the print next to the window, and, for convenience in focusing, bottom side up. The camera is focused on tracing in the same manner necessary for making a negative, but instead of charging the plate holders with dry plates the glossy velox is placed therein instead.

It is obvious that the light passing through the reversed tracing, thence through the lens and striking the sensitive paper will print it exactly as if the tracing was in contact with it. Using a large stop, an exposure of 1 to 1½ min-

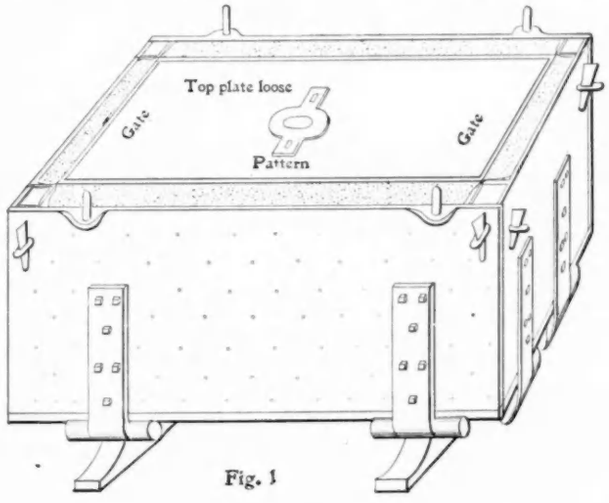


Fig. 1

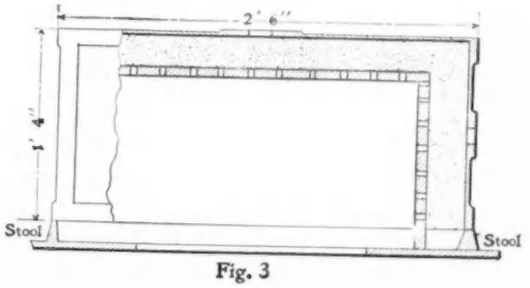


Fig. 3

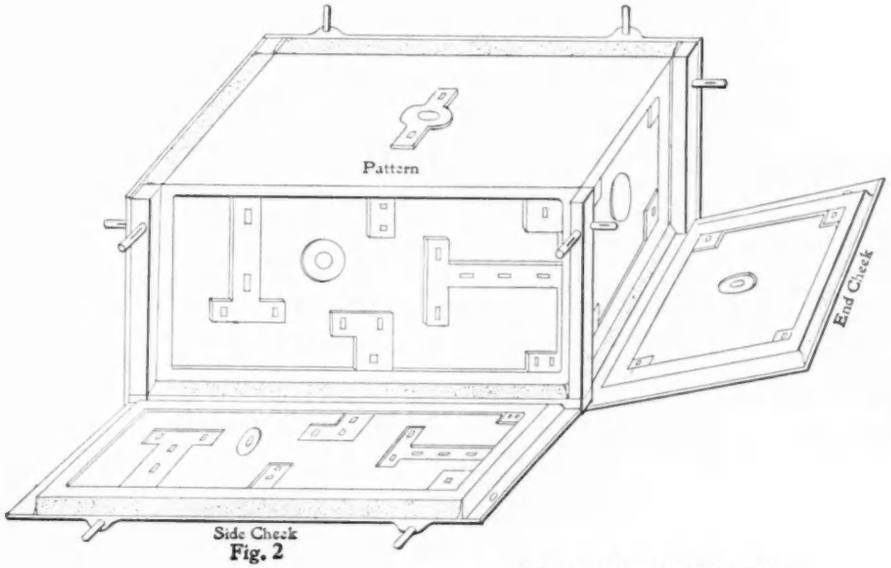


Fig. 2

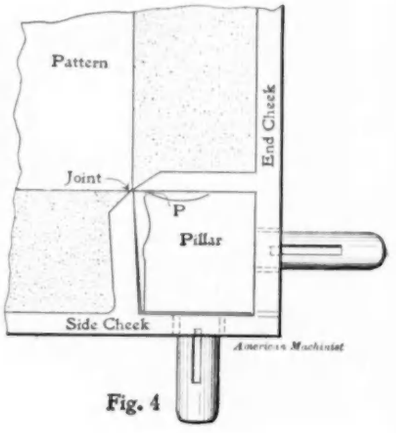


Fig. 4

A SPECIAL MOLDING OPERATION.

utes is usually sufficient when reducing from a 15x20-inch tracing to approximately 5x7 inches. The print is a positive, white lines on black background, and if the directions given by the Velox people are followed all the details are very clear, so much so that where the dimension figures are very small a reading glass resolves them clearly. For suporting the tracings in the window, it is convenient to use four spring clothes pins, tied to rubber bands, one for each corner of the tracing, though of course any device may be used that will cause the tracing to hang flat.

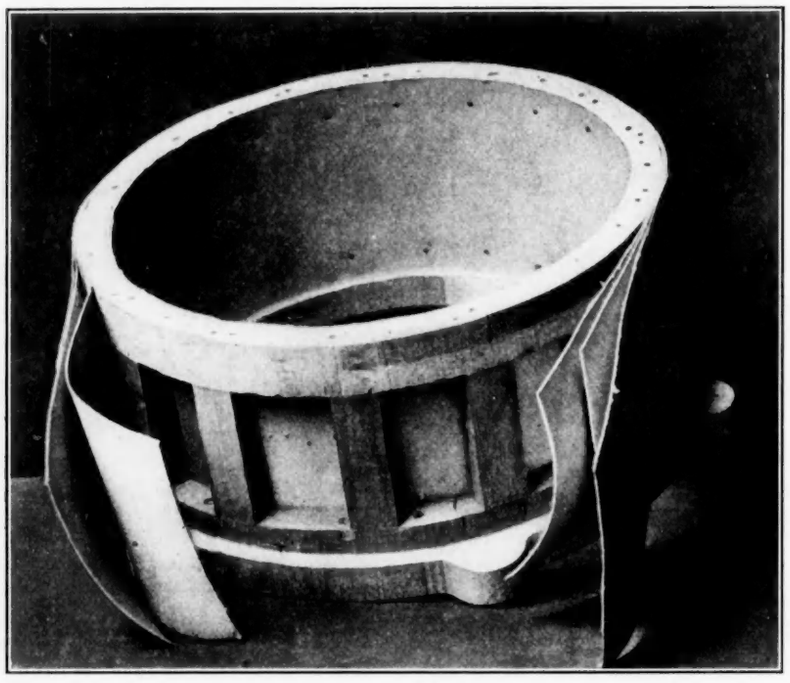
LESLIE E. HOWARD.

A Cheap and Quickly Made Pattern

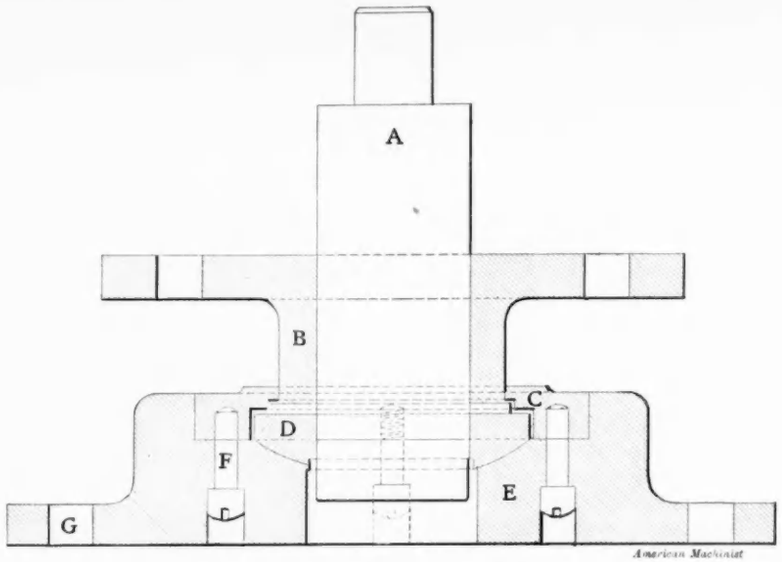
Editor American Machinist:

I send a photograph of a pattern from which but three castings of 42 inches diameter were wanted; all things considered, a pattern was thought cheaper than sweeps or cores. The first row of segments of the lower ring were roughly sawed out of the right thickness for the inner flange and the outer lugs and tacked on a board. A circle was struck on them for the inside and outside diameters of the second course, the segments of which were sawed out and screwed to the first course. Circles were then struck on the first course for the inner flange diameter and outer ring and the lugs were laid out. One segment of the second course being removed, the band saw was put through the joint and the inner flange sawed with draft. It was then taken off the saw and the segment replaced and the outside outline sawed. A similar method was then followed for the upper ring. The two rings were then separated with the distance pieces and the whole was covered with three thicknesses of heavy strawboard, for which allowance had been made. The photograph shows the pattern only partially covered. As these castings were machined all over we got them sufficiently accurate in this way.

J. L. GARD.



A CHEAP AND QUICKLY MADE PATTERN.



THE FIRST CUTTING AND DRAWING DIE.

The First Cutting and Drawing Die.

Editor American Machinist:

Some years ago it was quite difficult and unusual to roll sheet metal to such an accurate and even gage as it can be rolled to-day. The diemaker then could not draw up such smooth, deep shells or cups as are now done. I send a drawing and description of a cutting and drawing die, designed and patented by M. C. Stiles in 1875, intended to overcome many of the difficulties. The object was to get a die in which the drawing ring would adjust itself to the varying thicknesses of the sheets. These sheets would vary several thousandths of an inch in thickness, according to the width of the sheet. For instance, if a sheet was to be rolled 9 inches wide, from which, say, two rows of blanks were to be cut and drawn, the center of the sheet would be a little thicker, and sometimes several thousandths thicker, than the edges. Now, if such sheets were drawn in a rigid die, the thick side would draw up a longer edge than the thin side. In this adjustable die, the lower drawing ring is set into a spherical surfaced bed or holder, which allows it to accommodate itself to the variation in the thickness. By this system of dies we could draw up very true edges on the cups.

I had the pleasure of making the first die of this kind in 1875, while an apprentice at the works of the Stiles & Parker Press Company, which company has since been amalgamated with the E. W. Bliss Company, of Brooklyn. It certainly was a happy hour for me when I placed this set of dies into a double-action press and pulled up the first blank into a cup, as I remember the sizes, about 3⅛ inches diameter and 13-16 inch deep. At that time this was considered a splendid draw. The trial was made on I C tin; brass was tried later in this die and a much deeper cup was drawn. As this was the first die designed with the adjustable drawing ring, some of the old toolmakers doubted its ever working, so they told the foreman he had better give that job to one of the "kids," who had nothing to lose, and should it work it would be a feather in his cap. Well, I got the die to make and was glad of the job, as a set of drawings had been made for it (a rare thing for those days). I had only to follow the idea as shown, and the figures so far as they were given. My orders were, to take my time and make a good job. I was sure it would

work, so I took great pains to get every part right.

The sketch is made from memory and will give a good idea of the construction. The drawing of course does not show the proper clearance, as we changed the dies several times to try various thicknesses of metal. Every trial gave us good results. *A* is the drawing plunger, *B* the cutting punch, which also acts as a blank-holder, pressing the cut blank down upon the adjustable drawing ring *D*, which ring can adjust itself to the sheet metal to be drawn, the blank-holder or cutting punch *B* holding this ring in place while the drawing plunger *A* is withdrawing itself from this ring and stripping the cup from the plunger. There is a clearance of 1-64 inch between the cutting die *C* and the drawing ring *D*. This clearance must be had, so that this ring may swivel and adjust itself to any variation there may be in the metal which is being drawn. Ring *D* is set into a cast-iron bolster plate *E*. The cutting die is held in its place in this bolster plate by four, six or eight machine screws *F* (according to size of die), which are put in from the under side.

The cutting edge of this die was 4½ inches diameter. I mention this so that a general idea of the size may be had. The bolt holes *G* are used to fasten these parts on to the slide and bed of the press. There were a great many modifications made in this system of drawing dies from 1875 to 1882, all of which seemed to work well. While it is thus twenty-six years ago since the first die of this kind was made, I believe it will interest many of your readers to know why it was made.

Brooklyn, N. Y. F. C. FLADD.

Adjustable Washers for Setting Milling Cutters.

Editor American Machinist:

The tools, of which I enclose sketches, would be very useful in setting milling cutters to any exact distance from each other. The ring shown in Fig. 1 expands in length perhaps one-eighth of an inch in one revolution by means of the curve, and by this expansion the cutters are set. The sketches are self-explanatory. Such washers would be inexpensive if made in quantities.

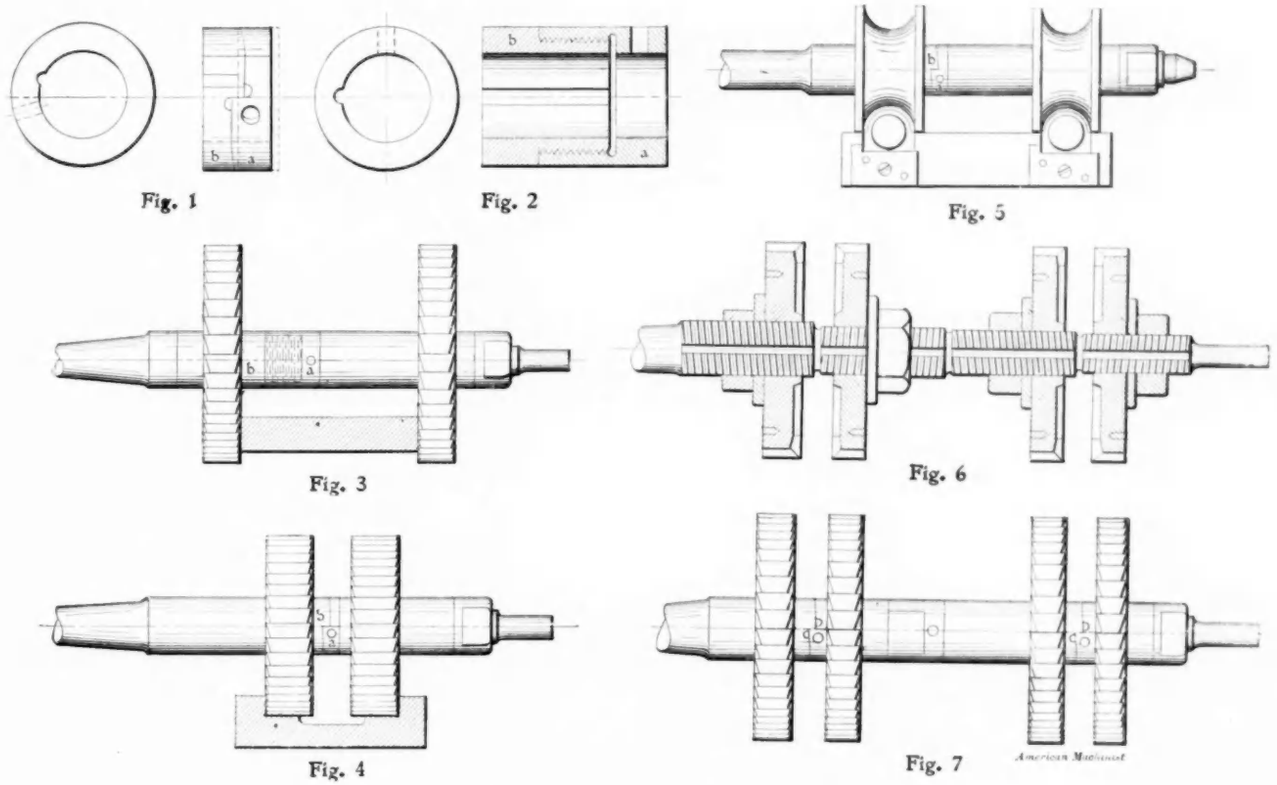


Fig. 1 Fig. 2 Fig. 5

Fig. 3 Fig. 6

Fig. 4 Fig. 7

SPACING WASHERS FOR STRADDLE MILLS.

Fig. 2 shows the old style rings for this purpose. Figs. 3, 4, 5 and 7 show how these rings are used. Fig. 6 shows the old expensive style of a set of milling cutters for hexagon nuts, etc. Fig. 7 is to compare with Fig. 6. OTTO ECKELT.

Berlin, Germany.

[We think it would be found necessary to make the washers with two inclined surfaces, each extending half-way round, with two meeting points opposite. Made as shown, there would be an unsupported place between the straight faces when the joint was opened for adjustment, and this would cause the cutters to wobble. The arrangement we propose would give two such unsupported places, which being opposite, would balance one another.—Ed.]

Some Boiler Experience.

Editor American Machinist:

Having seen in the "American Machinist" several articles on boilers and on blow-off connections for them, I wish to give my experience. I once had a job as machinist in a woolen mill where there were three of us besides the boss. I had just arrived from Scotland, having served my time in a small shop in a country district and I had not much experience in boilers or boiler setting. There were four boilers being put in of 70 horse-power each, 80 pounds pressure. They were tubular boilers. I remember that the contractor who was building in the boilers said it was best to have the brickwork under the boiler built up to within three inches at the back end, so as to bring the heat up to the boiler. I was working at the boilers and said it would be better to have at least 12 inches under the boiler and a soot hole and door at the back. The boss told them to pay no attention to what I said, as I was a newcomer and did not know much, so the boilers were built up close. I suggested having a main pipe on top and leading the four boilers into it. It was pointed out to me that no pipes would stand the pressure to have four at 80 pounds going into one, making it 320 pounds; however, I got the proprietor to consent and had it done that way, but it was watched with much care when the boilers were started.

The other trouble was having the blow-off pipes at the back on two of the boilers

which were not new. The blow-off pipes were cast iron and were bolted on at the bottom. I protested, saying the dirt might lodge if not continuously blown off, and might get the pipe burned and burst, but I was told it was the way these boilers had been run for four years in another place before I came; but, in that case, I explained, the feed water went in at the same pipe by a tee connection. Well, the boilers were built with the blow-off at the back and the feed pipe at the front. My work, along with the others, was to make repairs on the boilers or on any part of the mill and machinery. Being busy one day in the machine shop, which was close to the boiler house, I heard quite a loud report. I ran toward the boilers and I found the water running over the floor and the place full of steam; the firemen had run outside. I managed to get up to the valve and I shut it slowly, as I was afraid of my main connections from the other three boilers. The boss came and got the fire drawn. It was decided to put on a plate at the back and to put the blow-off in the front. A few days after I was putting on that plate when the other pipe burst. I managed to get out and closed the valve for that boiler. It was thought I had got scalded, but I was not much hurt. I may say that the "American Machinist" gave me information about boilers. I was anxious to know something about them. A few months after these experiences I got the brickwork about the boilers built to suit me, and several other changes were made before I left that place, having had charge of all the machinery in the mill for about eight years. A. SANGSTER.

Sherbrooke.

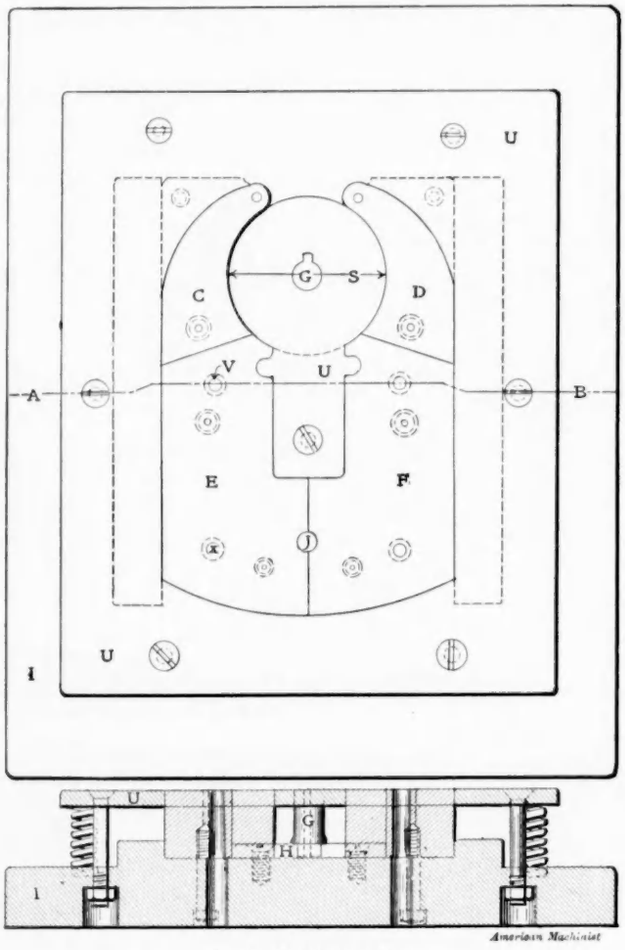


FIG. 1. A BUILT-UP DIE.

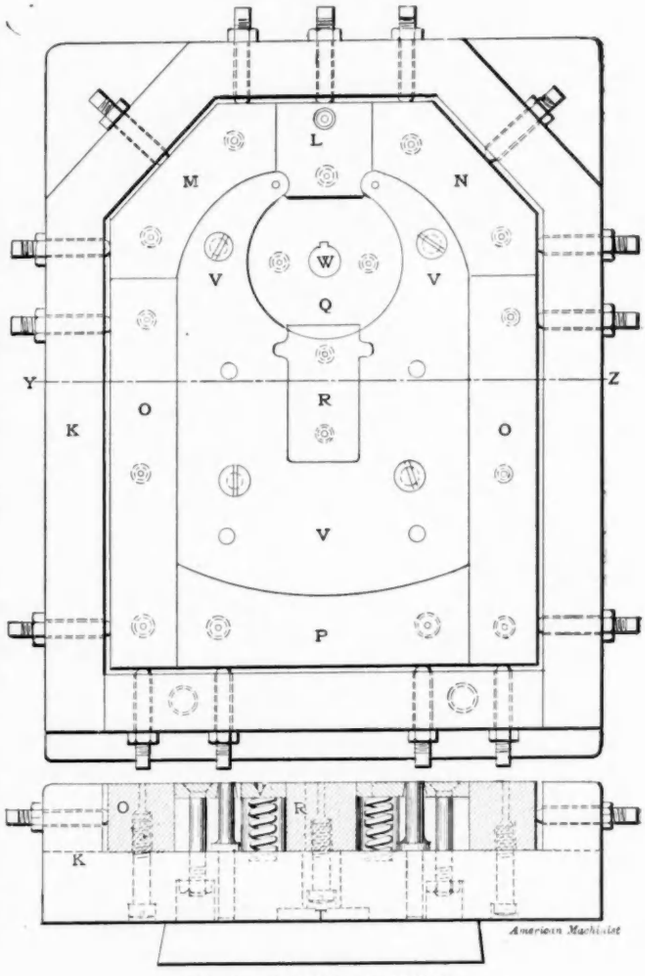


FIG. 2. A BUILT-UP PUNCH.

A Built-up Punch and Die.

Editor American Machinist:

Where it is desirable to produce punchings in great quantities, and also essential that they be accurate as regards dimensions and in many instances also reversible, with perfect alinement, then built-up dies are to my mind the proper thing. In presenting this die I wish particularly to show the number and shape of the sections which it was divided into, as it is a matter of importance in many respects in the construction of a die like this one shown in Figs. 1 and 2, that the divisions of the sections be well chosen. In deciding upon the sections that the die is to be built up with, it is desirable that we consider the possible effect of the hardening process and its consequent warping of the sections and make our divisions with a view to avoiding trouble in this respect; then also that in its assembled form the die be solid, and each individual section be well supported in position, and that its construction be as simple as possible to lessen the expense, which is always an important particular from the proprietor's standpoint.

The punchings from this die were of .014 inch thick sheet iron, and in shape as shown at Fig. 3.

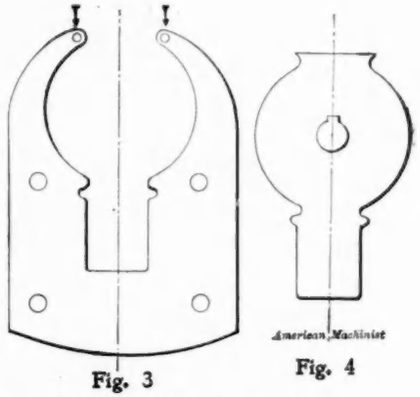


Fig. 3 Fig. 4

THE PUNCHING AND THE SCRAP.

Fig. 1 is a plan and section on line *A B* of the die, and Fig. 2 a plan and partial section on line *Y Z* of the punch.

In Fig. 1 the die proper is shown built up in four sections, *C*, *D*, *E* and *F*. After

making the necessary templets the sections were shaped up and drilled for screws, dowels and punch holes. A few thousandths of an inch were left for grinding on all surfaces where it was convenient to do so, the rest being finished to templets with the file. After hardening and grinding the bottom sides and the faces designated by *x*, the sections were fastened by screws and dowels to a ⅜-inch thick plate which held them convenient for handling in the further operations required to make the whole conform to the templet.

The upper cast-iron holder *K*, Fig. 2, was planed top and bottom to receive sections *L, M, N, O, P, Q, R*, which, like *C, D, E, F*, were hardened after first being shaped up, leaving a few thousandths for grinding, and having the holes drilled for screws and dowels to fasten them to the holder. The adjoining and cutting faces of those sections were fitted by grinding so as to conform perfectly with the assembled die Fig. 1. These sections were then secured to the holder. The bottom cast-iron holder *I* was planed to receive sections *C, D, E, F*, also the central punch *G*, which was riveted to plate *H*, which was turned to fit the diameter *S*; thus it will be seen that with the plate *H* screwed and doweled at the holder and the sections *E* and *F* also doweled and screwed to the holder, the whole together was built up into an assembly die which was solid and securely held in position in the holder.

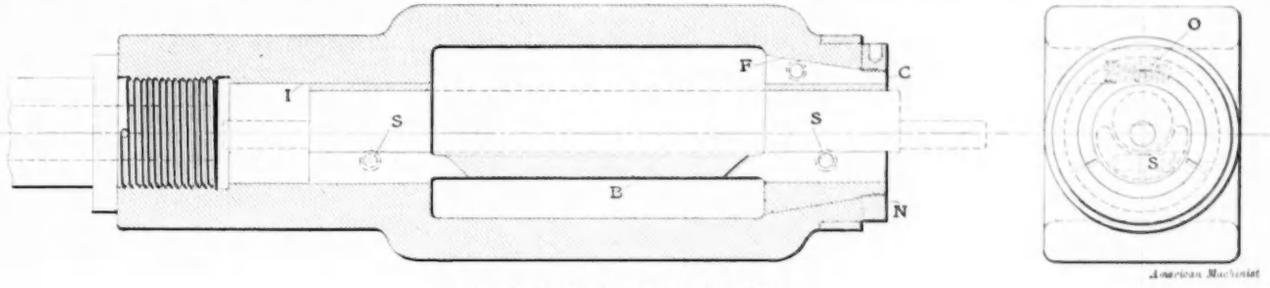
The sections in holder K also were all doweled to the holder after being properly adjusted by the set-screws to conform to the shape of the assembly die. The small punch holes in sections *E* and *F*, Fig. 1, were bushed as shown by the dotted lines in the plan. *U* and *V* are stripper plates, which are made effective by placing rubber or steel springs under them. The central scrap punching at *W*, Fig. 2, worked up and out at *T* in the section view. The piece made by this die, Fig. 3, was a field punching of an electric motor. The strip of sheet metal was guided along the die by two spring pins, not shown, in the stripper plate, Fig. 1, so as to leave a very slight selvage at the points designated by the arrows in Fig. 3. A scrap punching, Fig. 4, was formed and this scrap was made into armature disks by a combination armature die.

WM. M. SPRY.

A Rig for Turning Eccentric Shafts.

Editor American Machinist:

Eccentric shafts similar to back gear shafts are expensive things to make when turned on centers in the ordinary way. The amount of throw sometimes makes it necessary to use very small centers and sometimes one center is cut entirely away. To avoid these difficulties and insure a better job by overcoming the error in laying out centers and wear of same, the fixture shown in the sketch was designed and has proved to be a good tool.



ECCENTRIC-SHAFT TURNING FIXTURE.

The body of the fixture, as will be seen by the sketch, is threaded at one end to fit the thread of a lathe spindle and turned true on the outside at the other end, so that it can be run in a steady rest. It should have a hardened collar at this point. The inside at *I* is bored to fit bushing *B* and at *F* is bored taper to receive bushing *C*, the bore of which fits the split bushing *B*. *C* is split and can be drawn into the taper hole by nut *N*. When nut *N* is loosened *C* is opened by spring *O*, which is held in place by a small screw.

In use the turned or ground shaft is inserted in bushing *B* and clamped by screws *S*. Bushing *B*, as shown in the sketch, is then placed in the fixture and clamped by the closing of bushing *C*. The shaft is now in position to turn one end and when that end is finished the bushing is reversed in the fixture and the other end operated upon without being removed from *B*. With this rig the work is held rigid, permitting a heavy cut to be taken and the amount of throw on each end is the same.

W. R. G.

Dividing a Circular Piece in Halves.

Editor American Machinist:

While it is generally conceded that the use of special tools and fixtures is advantageous when many similar parts are to be operated upon, it sometimes occurs that special appliances can be profitably employed when the number of parts is quite

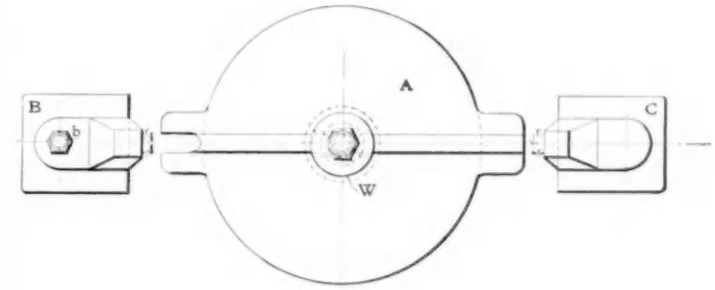


Fig. 1

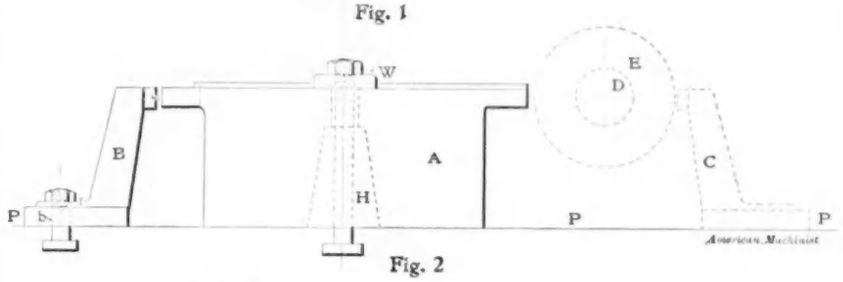


Fig. 2

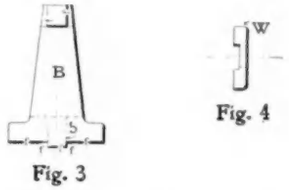


Fig. 3

Fig. 4

A SIMPLE RIG FOR DIVIDING A CIRCULAR PIECE IN HALVES.

small. Having frequently to mill the bolt slots in housings for circular milling attachments in lots of from three to twelve, and finding the operation difficult of quick accomplishment by unskilled labor and with ordinary means, the fixtures shown in the accompanying sketches were devised.

Fig. 1 is a plan view showing housing *A*, fixtures *B* and *C*, and recessed washer *W*, and Fig. 2 is a side view of the same parts with arbor *D* carrying cutter *E* just before starting cut. Fig. 3 is an end view of fixture *B*, and Fig. 4 a side view of recessed washer *W*.

B and *C* are of cast iron and differ only in that *B* has bolt hole *b*, and *C* has none; both are finished as indicated at *f*.

In operation *B* is bolted to platen *P*. With bolt inserted, *A* is shoved and twisted to position, where its tongue coincides with projections on *B* and *C* and then clamped. *C*, which is loose, is then pushed out of the way, the table is raised and the cut started. By revolving *A* one-half turn and repeating the operation the piece is completed. Conical holes *H* could not well be used as fulcrums, owing to the fact that some were larger than others.

A. B. CHRISTMAN.

Roller Thrust Bearing.

Editor American Machinist:

I wonder if the article on a roller thrust bearing by Mr. C. R. Pratt, in your issue No. 26, will attract the attention it deserves, or if the significance of the figures which he gives for the loads carried will be recognized. The loads given by Mr. Pratt are well above those developed by most steamships and are not much short of those developed in the largest war vessels.

According to "Screw Propellers and Marine Propulsion," by I. McKim Chase, M. E., first edition, 1895, on the United States cruiser "New York," each shaft has a thrust of 100,737 pounds at 135 revolutions per minute and 8,473 indicated horse-power per shaft. This is only 25 per cent. in excess of the load and less than half the speed of the shaft that Mr. Pratt's roller thrust takes care of, and it would seem probable that it would take care of this duty successfully.

On the United States cruiser "Columbia" each of the three shafts has a thrust load of 70,185 pounds at 133 revolutions per minute, with 6,000 indicated horse-power per shaft, and on the United States cruiser "Detroit" each shaft has 38,450 pounds at 170 revolutions per minute and 2,577 indicated horse-power per shaft.

These figures speak for themselves, and it would therefore seem evident that this roller thrust bearing, with its average loads of 20,000 pounds and maximum loads of 80,000 pounds at 300 revolutions per minute, could easily take care of the thrust of the proper shaft on a large vessel and it certainly presents attractive possibilities in this line. C. O. GRIFFIN.

Some New Things.

AN ELECTRICALLY DRIVEN SENSITIVE DRILL.

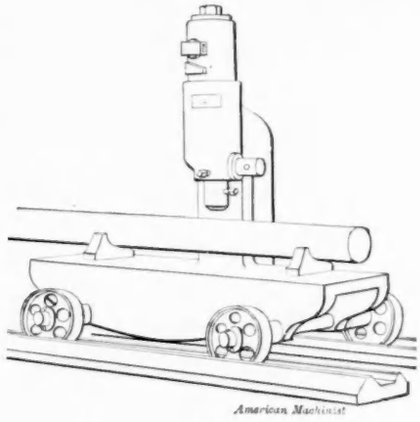
The machine shown, while it is so evidently simple, is still adapted to a wide range of work. The column is a steel tube with a weight inside which counterbalances the table. The vertical shaft of the motor is made hollow, so that the surplus oil from the upper bearing will lubricate the lower one. There are three speeds to the spindle by changing the belt on the cone pulleys. This belt is made endless, so that it will run smoothly, and means are provided for taking up the slack if it stretches. The switch for starting and

ELECTRICALLY DRIVEN SENSITIVE DRILL.

stopping is inclosed in the motor. This drill was designed and is built by James F. Willey, Jeffersonville, Indiana.

A PORTABLE HYDRAULIC SHAFT STRAIGHTENER.

The cut shows a hydraulic shaft straightener that may be used upon lathes, say, from 24-inch swing, or as a portable tool around the shop. The axles allow the wheels to move to accommodate the ways of the lathe, and V-blocks are used above which are adapted to the size of the work and the hight of the lathe centers. There is a rack movement to the ram, with steel pinion shaft, the ram itself being of tool steel. The pump is of bronze. The steel trussed girder bed is 25 inches long, 2⅛ inches from back of jaw to center of ram, and a 3½-inch shaft can be bent easily. All the working parts are easy of access. The total hight is 33 inches and the weight



A PORTABLE HYDRAULIC SHAFT STRAIGHTENER.

375 pounds. It is made by the Watson-Stillman Company, East Forty-third street, New York city.

New Corporations.

Automatic Coin Machine Co., of Rochester, N. Y. Directors: L. F. Jones, Buffalo; J. G. Schenaier and H. G. Nicoll, Rochester.

Field Force Pump Co., of Lockport, N. Y.; capital, $50,000. Directors: W. S. Chapman, C. A. Barnes and Laura B. Chapman, of Lockport.

"American Ferrofix Co.," of New York city. Directors: Hugh Armour Ward and Electus B. Ward, New York city; Henry M. Magie, Rutherford, N. J.

The Maltby Automobile & Manufacturing Co., of Brooklyn, N. Y.; capital, $20,000. Directors: I. S. Cormer, F. E. Phillips, C. C. Protheroe, New York city.

The Richard Megson Co.; for manufacturing machinery and mill work; capital stock, $200,000. The president and treasurer is Richard Megson, of Cambridge, Mass.

Keystone Seal & Press Co.; principal office, Corporation Trust Co. Building, Jersey City, N. J.; capital, $200,000. Incorporators: Irving C. Green, Horace S. Gould, K. K. McLaren.

Garland Tie Machine & Manufacturing Co.; principal office, 185 Montgomery street, Jersey City, N. J.; capital, $100,000. Incorporators: G. W. Garland, E. T. Oliver, John W. Avery.

Hassett Machine Co.; principal office, Kearny, N. J.; object, manufacturing textile machinery; capital, $25,000. Incorporators: Wm. H. Hassett, Carrie C. Hassett, Edwin Kenney.

Ajax Motor Vehicle Co., room 100, 32 Broadway, New York city; capital, $10,000. A. L. Simpson is president and general manager, and Walter Simpson, secretary and treasurer.

Ashland Emery Co.; to mine and prepare emery for the market; capital, $800,000. Incorporators: L. R. Speare, Boston; C. A. Santd, Easton, Pa.; S. C. Smith, Phillipsburg, N. J.

D. Saunders' Sons, of Yonkers, N. Y.; to manufacture pipe threading and cutting machinery; capital, $75,000. Directors: Alexander Saunders, L. M. Saunders and Ervin Saunders, of Yonkers.